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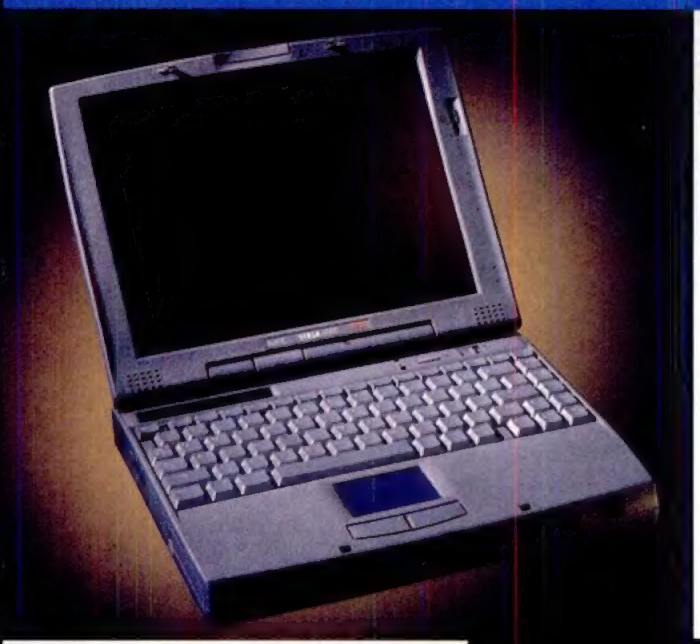

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Netscape or IE? Both.

Just when you thought it was safe to browse the Internet, along come new browsers that threaten to change everything. Our testers in PC Labs have spent a lot of time with the new releases from both Microsoft and Netscape, and the results appear in the story on page 100. But perhaps the biggest question is whether you should upgrade at all.

To me, the answer is a clear *yes*—but not for the reasons that seem to have received the most hype, such as push technology and desktop integration. The new browsers are simply better.

Each fixes a number of problems, some little and some big. Each has a number of enhancements that make browsing easier. I particularly like the "Explorer bars" in IE 4.0, which let you easily go back through your history or see any page that is in your cache. And I like Netscape's SmartUpdate feature. In addition, many sites are beginning to add content that can best be viewed with features available only in the new browsers, such as dynamic HTML.

I like the concept of push content, such as news tickers, staying on your computer. Eventually, I expect the model to become more like television, with various channels. But as I look at Netscape's Netcaster or IE's Active Channels today, I don't see a whole lot of compelling content.

I certainly like the idea of having some material on my hard disk so that I don't have to wait for the Web to download it. Still, push has hardly had the pull its proponents claimed it would have. For me, the best push is still e-mail.

In general, then, the new browsers do more, are better designed, and are faster.

Microsoft really touts the new Web-integration capabilities of Internet Explorer 4.0, which let you use your browser as the interface to everything, including your hard disk. This innovation is clearly influencing Netscape. It recently started talking about its plan for using the browser as the interface for looking at files on your hard disk, a local intranet server, or the Internet—just as Microsoft claims to do. Still, in reality, IE defaults with these options off. And though some of these features sound good (such as using single clicks instead of double clicks to open files), using the browser as an interface is a big change, and it's not all working as smoothly as you'd like. The concept isn't bad, and IE is a good start, but thus far I'm not convinced the new technology is ready for prime time quite yet.

Both Microsoft and Netscape are pushing their browsers as applications-development platforms. I do think that's a great idea, but if you're using the Internet as a development platform, then you probably know what browsers you'll need, and you don't want to change browsers until you've tested the new versions very carefully.

Which browser should you get? If you could pick only one, we'd give the nod to IE 4.0 right now. The two browsers have been playing leapfrog, and at the moment, Microsoft is on top.

However, I think you should have both browsers on your system. Mostly this is because I often run into sites that support Netscape's latest features and thus look great in Navigator but don't look right in the Microsoft browser. That's been the case for some time, and it continues to be true. And now that Microsoft has more supporters, I'm more often running into sites that look great in IE but don't work right in Navigator.

This situation occurs because, although things like basic HTML display are standards, the new browsers are different in other ways. They have different implementations of JavaScript, support slightly different tags, and have almost completely different interpretations of dynamic HTML.

You can easily get both browsers. Microsoft has made its browser free. While Netscape charges corporate customers, you can download a copy free "for evaluation," and the company is committed to a program of putting browsers on millions of disks that will be distributed free.

Besides, I don't think either browser is nearly as stable or complete as it should be. If you're a heavy Internet user, you probably download new versions frequently, because whenever there's a new browser, we always hear about some new security bug or some new fix. But I'm glad to have two browsers in competition. It keeps both vendors moving forward.

MICHAEL J. MILLER

PHOTOGRAPH BY SHONNA VALESKA

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All comparisons are made with NT PCs loaded with the Intel Pentium II processor.

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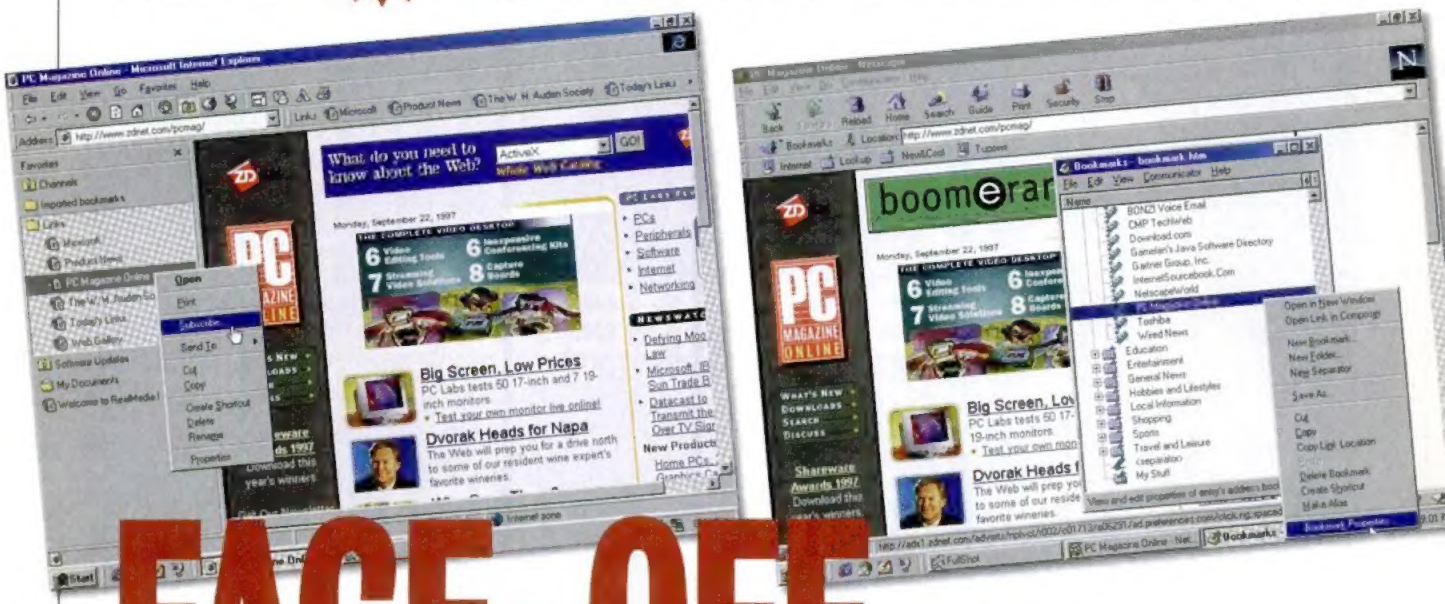
COVER STORY

IE4 vs. COMMUNICATOR



FACE-OFF

BY JOHN CLYMAN

One of those moments that you've been both looking forward to dreading and is here. You must decide whether or not to upgrade to a next-generation browser. And, if the answer is yes, which one? Don't sweat it on your own. You've come to the right place. In this issue, we look at these new browsers, which are now more like centerpieces in suites of Internet client applications. We view them from every possible angle and give you a feature-by-feature breakdown 100

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We're Having a Party

Mark your calendar! On the evening of Monday, November 17, *PC Magazine* will present its annual Awards for Technical Excellence at a gala ceremony at the Comdex trade show in Las Vegas. Join us online for a live streaming-video cybercast: Download the RealPlayer plug-in and keep watching our Web site for details. Black tie is optional.

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Pipeline

$300 Billion in Chips

Market research firm Dataquest has released rosy projections for the semiconductor market over the next four years. Global revenues were $142 billion in 1996 (a 6.3 percent decline from 1995) and are projected to reach $150 billion by the end of 1997, marking a period of relatively slow growth blamed largely on low pricing.

Dataquest forecasts, however, that the semiconductor market not only will show double-digit growth in 1998 but will sustain such growth through the year 2001, when the market is expected to surpass $300 billion. That forecast represents a doubling of global demand for semiconductors in four years.

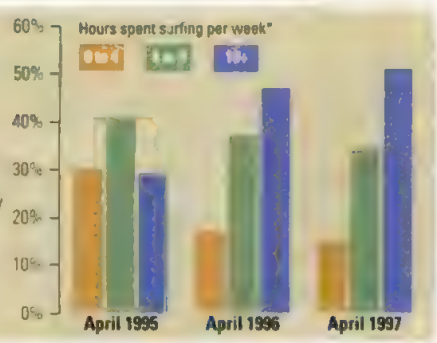
In concert with the healthy growth, semiconductor makers must contend with DRAM supply issues. "We believe that excess DRAM capacity exists this year and that the DRAM oversupply will persist throughout most of 1998," says Ron Bohn, an analyst for Dataquest's worldwide research operations. "But we also realize that DRAM suppliers will try to be skillful in managing their use of DRAM capacity to minimize the impact of oversupply. The long-term forecast explicitly assumes a period of DRAM capacity shortage starting by early 1999, followed two years later by excess DRAM capacity."

Bohn sees emerging applications and new products as fueling semiconductor growth over the next four years. "Emerging applications (especially in communications and digital consumer electronics) and the trend toward system-level integration mean especially high long-term growth rates for embedded microprocessors and microcontrollers, digital signal processors, digital cell-based ICs, programmable logic devices, and EEPROM," he says.

Recently announced chip-manufacturing innovations from both IBM and Intel (for more information see Trends, page 28) may also have a big impact on growth in the semiconductor market over the next few years.

What's Your Daily Dose?

Over two years, the percentage of Web users who surf for 10 hours or more a week exploded from 29 percent to 51 percent. They spend an average of 13.6 hours a week on the Web



* Based on Web users surveyed
Source: Georgia Institute of Technology and Goldman Sachs

CompUSA Builds to Order

Attempting to beat Dell at Dell's own game, longtime PC retailer CompUSA—which serves over 60 metropolitan markets—is entering the build-to-order business with the CompUSA PC American Pro, a new premium system, and the more modest CompUSA PC American.

You can purchase the systems not only by phone and via the Web but at CompUSA's 134 superstore outlets as well.

CompUSA hopes to gain an edge with its retail stores, where trained staffers can provide customers with aid and advice both during and after the ordering process.

High-Tech Talent Search

Here's some good news for college students with a high-tech bent: One out of every ten information technology jobs in the U.S. goes unfilled, because employers can't find appropriately trained workers—a shortfall that's expected to threaten the entire industry's growth.

This statistic—based on a study by the Information Technology Association of America—has galvanized leaders from industry, academia, and the government, who have been brainstorming collectively on how to reverse the trend.

At a meeting in mid-January, they plan to address the problem by finding ways to improve math and science competency and expanding access to technology and postsecondary education.

Meanwhile, research firm Gartner Group expects that job openings in the IT industry will significantly outstrip the supply of workers through 2002. It predicts that for every ten full-time hires required, only seven professionals will be available.

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First Looks: Now Online — First Looks online is now reviewing PCs, software, and peripherals on the same day the products ship.

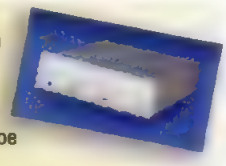
And Don't Miss These Web Extras — We have daily reports from the PC industry's cutting edge as well as weekly commentary from John C. Dvorak, Michael Miller, and Don Willmott.

Pipeline

Recordable DVD Spinout

Even though CD-R hasn't exactly taken the PC industry by storm, the battle to control the market for its successor has already been joined. Rewritable DVD surpasses CD-ROM in storage space (about 5.16GB in a double-sided format) and data-transfer rates, but with competing standards on the table, a volatile debate is taking shape.

One side, represented by DVD Forum—a consortium of industry bigwigs including Hitachi, Matsushita Electric, and Toshiba—recently completed a DVD specification, called DVD-RAM 1.0. Consumers should start seeing volume production of DVD-RAM drives in the first quarter of next year. But according to Hitachi, computer manufacturers still have a lot of work to do on DVD software drivers that will run under Windows 98. Microsoft has pushed Windows 98's release date to the second quarter of 1998, which could complicate the release of DVD-RAM drives.



Ship date: December 1997.
Capacity: 2.6GB on single-sided disk, 5.2GB on double-sided disk.
Design: Single-sided disks will be available with or without protective cartridges; double-sided disks will be available only with cartridges.
Method: Disks record data on both land and groove tracks.

Meanwhile, the competing camp—composed of Hewlett-Packard, Philips Electronics, and Sony—is working on an alternative called DVD+RW, to address what it says are DVD-RAM's shortcomings. Hewlett-Packard says DVD+RW resembles CD-ROM more than DVD-RAM does. That fact will make DVD+RW more compatible than DVD-RAM with CD technologies and DVD-ROM.

For Stock Market Pros Only

This year's increase in financial market volatility has heightened interest in software that might protect against market downturns. Until recently, individuals rarely had access to institutional-quality software for portfolio analysis. Although it's more available, risk management still isn't simple.

Riskview, a free Web service, provides data and software tools for calculating historical returns, forecasting volatility and correlations, and calculating value at risk (VaR)—the most widely used measure of risk at broker trading desks.

Another approach money-management pros favor is style analysis, which seeks to assess a portfolio by comparing it to a set of benchmarks. Ascent 2.0, from Morningstar (800-735-0700), has a portfolio analyzer with style analysis capabilities and data on over 8,000 mutual funds.

A little-known weakness of standard risk-management approaches is that they rely on the decades-old, overly simple means-variance optimization. Sponsor-Software Systems (212-724-7535) is a pioneer in "downside deviation," a more accurate gauge. It costs over $10,000, but individuals with a high net worth who actively manage their portfolios may find that the greater accuracy justifies the investment.

ILLUSTRATIONS BY CYRIL CABRY (BOTTOM LEFT), SCOTT MENCHIN (CENTER), M. E. COHEN (TOP RIGHT).

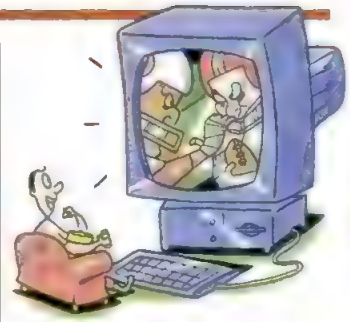
THIS ISSUE'S CONTRIBUTORS: *Marc M. Groz, Angela Hickman, Carol Levin, Cade Metz, Sebastian Rupley, and Don Willmott.*

Looking for Lost Kids

Can the Web help locate missing children? A program is underway to establish a "Find Missing Kids Now" network comprising millions of Web pages of photos and information. The Web's real-time nature lets parents and police take quick action, say organizers.

Safeguarding Our Children—United Mothers (*www.soc-um.org*) is spearheading the effort. Last spring the organization asked PageCount, maker of a Web-traffic counter, to post a kidnapped little boy's photo on the Web sites that run PageCount counters. The company agreed and got 28,000 hits.

By "pasting" a special tag in its customers' Web pages, PageCount was able to replace ad banners with links to pages reporting the child's disappearance. DigiWeb, Link Exchange, SimpleNet, and SmartNet have signed up to participate. And America Online, Digital City, and the National Center for Missing and Exploited Children are launching a similar program.



Better TV Than TV

In an effort to get DVD-equipped PCs to outdo TVs and enhanced TVs in picture quality, Microsoft has come up with two software algorithms called Bob and Weave. As newcomers to Microsoft's Entertainment PC '98 specification, they're part of an effort to get makers of graphics accelerators and decoders to deliver what Microsoft calls "better TV than TV."

A Microsoft research paper describes Bob as "a method of displaying video data to show each field individually (similar to a television) using an overlay." Weave, on the other hand, blends two interlaced images into a frame and produces crisper images than Bob's. The upcoming Windows 98 will be able to switch between the two video algorithms.

Microsoft's next challenge is to convince hardware makers to adopt the Bob and Weave algorithms, but so far there are few takers.

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Source: PC Data; data for August 1997

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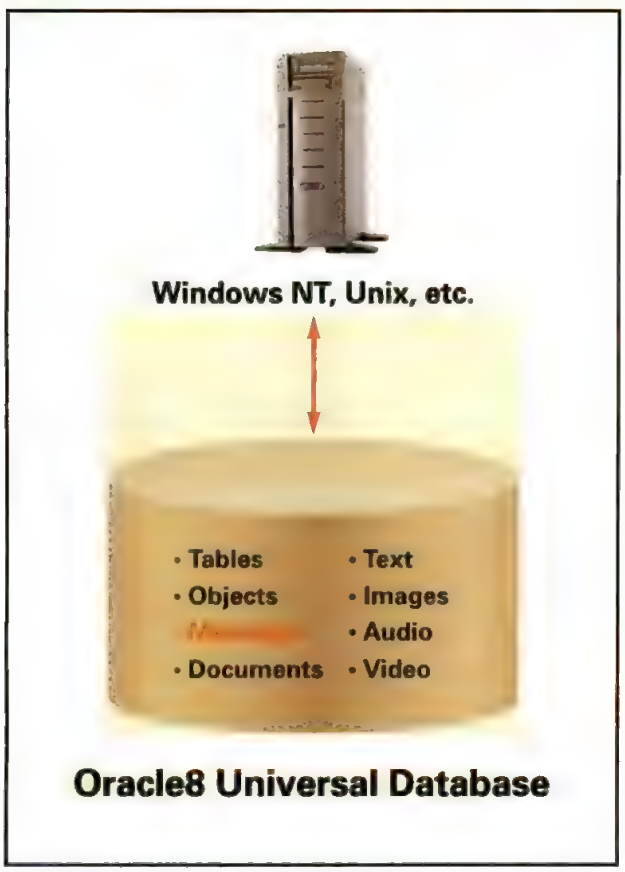

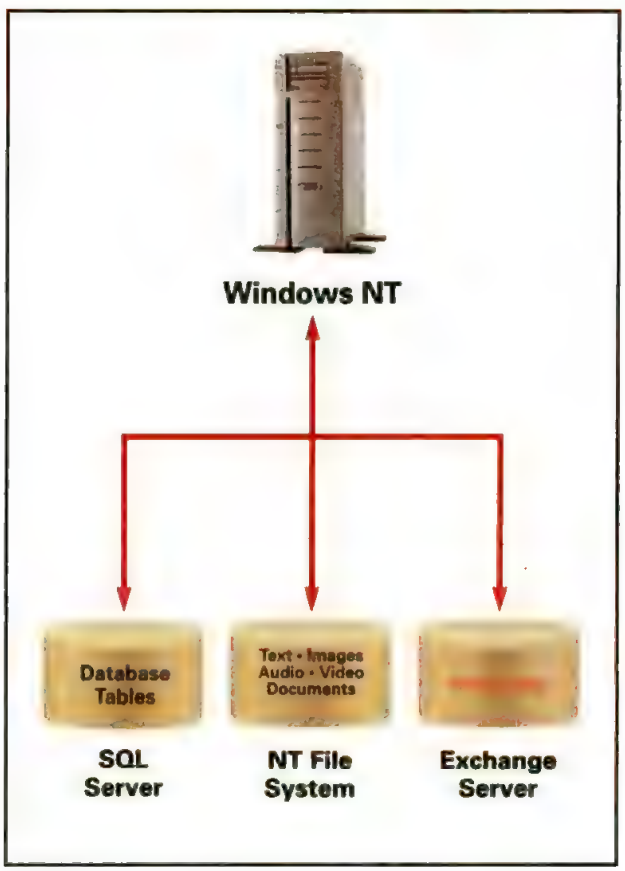

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Letters

PERFORMING AT 300

PC Magazine's cover story "The Two Faces of 300 MHz" (September 23, 1997) should have been renamed "Fastest AGP Technologies in PCs." From the data and pricing presented on the seven models of PCs reviewed, it appears you awarded the Editors' Choice simply to the PC that handled 3-D performance best. Although your article highlighted a test of 300-MHz Pentium II PCs, the Micron PC you selected failed to rank first against any of the competition outside of the ZD 3D WinMark 97 series of tests. Additionally, the Micron PC had a higher price tag for comparatively low ZD Business Winstone 97 benchmark test results and a smaller feature set. Where did *PC Magazine* take general system value into account when deciding on the Editors' Choice? Your article claims that you tested "high-end PCs for mainstream users and personal workstations for 2-D/3-D graphics." Mainstream users rely on value and performance from their PCs, and your reviews should have maintained that focus.

WILLIAM W. LIDSTER
via the Internet

Regarding your article "The Two Faces of 300 MHz," it would be of considerable value to include MFLOPS, SPEC95, and Graphics Picture benchmark test performance numbers in all your reviews in the future so that comparisons to Unix machines could be made. I was also disappointed that the same tests (AutoCAD, for example) were not run on both PC architectures. The intrinsic value of these 3-D workstations is not apparent other than in their ability to spin a textured 3-D model dynamically in real time.

GERRY BRENNAN
San Fernando, California

DVORAK GOES POP

In his column of September 23, 1997 ("Talk About Pop Music"), Dvorak extols the possibilities of DVD for pop music but displays a disarming lack of knowledge about intellectual property rights. He remarks that there may not be a large market for a 45-minute CD of rockabilly music from the 1950s priced at $16, but there may be one for a 14-hour disk, priced at $16, with every rockabilly song ever recorded. In order to release any song or recording that has not fallen into the public domain (and no rockabilly records have), you must acquire rights from the owner of the recording (the record company) and pay royalties to the songwriters and artists. Therefore, the idea of 14 hours of music selling for $16 (or even $50) is ludicrous.

RICHARD FANNAN
Los Angeles, California

"Your reviews of 300-MHz PCs should have focused on value and performance."

I couldn't agree more that record companies have been overpricing CDs. But technology is not what will change this situation (this is a matter for a different discussion). More pertinently, is a $16 DVD with hundreds of songs on it a realistic idea? A DVD containing every rockabilly song, as Dvorak suggests, would be impossible unless the artists got zilch.

ALEX TORRALBAS
New York, New York

Because Dvorak wrote about MPEG audio stream layer 3, now every Tom, Dick, and Harry is going to ruin what was once a nice, new, fun area of the Internet. What's the next thing he'll ruin for the few people on the Internet who are having fun?

On the other hand, I agree with his assessment of WebExpress (Inside Track, September 23, 1997). It is far superior to FrontPage (for Windows), but I still like to use a program like BBEdit on the Macintosh. For Windows, WebExpress creates much cleaner code than FrontPage ever will.

DOUG LY
via the Internet

CHIP SET CHAT

I commend your excellent coverage of the Cyrix 6x86MX CPU ("Affordable Desktop Power," First Looks, September 23, 1997) as an alternative to AMD and Intel, but I must point out a gross oversight in the comments referring to supporting chip sets for Socket 7 architecture. You state that "the Intel 430TX, for instance, is the only Socket 7 chip set that allows for 33-MBps hard disk transfer rates." The Apollo chip set, from VIA, and the 640 chip set, from AMD, both support Ultra DMA. The VIA and AMD chip sets are for Socket 7 architecture and are highly tuned for Pentium MMX technology.

By not notifying readers of these products, you show a bias for Intel products over equally good chip sets. The VIA and AMD chip sets support every feature that the Intel 430TX chip set does and more: They allow for more memory access and larger CPU caches. The only truth that was stated about these chip sets was in regard to AGP support. And considering that the AGP idea is really from the PCI 2.1 specification, it's not that big a deal. If every PCI card supported the 66-MHz rate, then AGP wouldn't be needed as a separate and proprietary bus to be manipulated by Intel.

CHAD WILSON
via the Internet

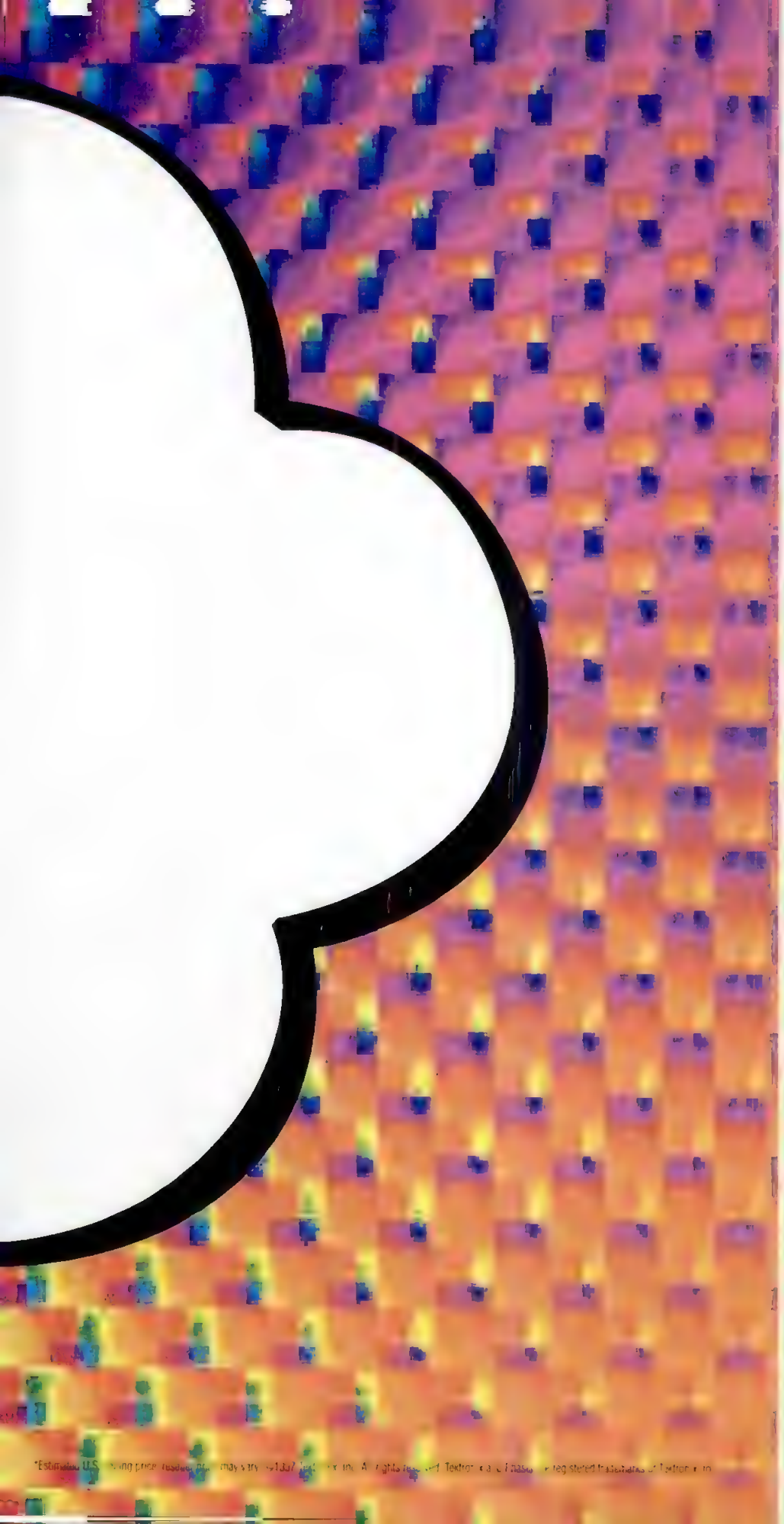
The Apollo VP2 from VIA (which is also licensed to AMD and tagged with the AMD 640 name) and the Apollo VPX (which supports Cyrix's 75-MHz bus) both support Ultra DMA (see "Corrections and Amplifications"). Neither chip set was used by the 6x86MX machines in our roundup, but each is currently available in volume.—Ed.

SOME WILL GO TO MEMPHIS

Since Jake Kirchner took up residence in Trends, I haven't agreed with a word he has written. That is, until I read his September 23 column, "Windows 98: The Whining Has Already Begun." It was right on target, and I applaud Kirchner for taking his colleagues to task on their collective coverage of Memphis to date. I for one will be upgrading to Memphis soon after it is released. Memphis will allow me to squeeze a little more life out of an old Pentium/90 by providing a better file system and support for faster I/O technologies. By investing about $500 in upgrading my system, adding Windows 98, and moving cards off the ISA bus, I'll be able to keep my old machine usable. Sure, it won't touch a blazing Pentium II, but I don't need it to. I just need a marginal performance gain to keep me in the game long enough to save up enough for one of those monster machines.

Memphis, with its support for such technologies, will hit the shelves right when I and many others need it. Considering my daily 6 to 8 hours spent on the Internet, along with most of my clients, the interface changes will come in handy also. The "pundits" and "experts" can whine all they like. For the average person using a personal computer, Memphis may be just what the doctor ordered.

C.D. EGGER
via the Internet



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Letters

SPEAKING IN SHORTHAND

My thanks to Michael J. Miller for his assessment of voice recognition software ("I. Want. To. Talk. To. You.," September 23, 1997). I won't buy any of these programs yet, because they are too cumbersome and limited for my needs as a reporter and editor. I hope that software developers have a wider view of the uses of voice recognition technology than what these nascent programs indicate. The programs are designed for one person's use, yet most information-intensive work these days is done in group settings. Sometimes I carry a laptop to meetings only to find that I can't type fast enough to record all the information I need, and that I'm disturbing others with my aggressive keyboarding. I'm back to using a tape recorder and legal pad. But tapes require transcribing, which means extra hours of work or the expense of sending them out.

I'd like a lightweight tape recorder that can record for many hours on a file that can be transferred to my office PC (or sent by e-mail if I'm traveling). I'd like software that can take a massive voice file with many different speakers and transcribe it quickly and accurately, while learning the jargon specific to my field. If I have to, I'll wait tenyears, as Miller suggests, for the speech recognition device I need. Meanwhile, I'll take shorthand.

KIRSTEN GOLDBERG
Washington, D.C.

COAXIAL CONUNDRUM

I don't know much about small-office networks, so the article "Network in a Box" (September 23, 1997) was quite informative. However, it focused on hub systems, mentioning coaxial only in the sidebar "And Then There Are the Cables." The sidebar notes a risk: that the failure of any cable or adapter could bring down the whole network. My office has two networked computers, so any failure brings my whole network down anyway. I use coaxial, which leaves me with one less component that can fail. In a small office, there just aren't enough pieces to make failure either likely or difficult to diagnose.

STEVE SCHONBERGER
Redmond, Washington

CHARTING THE MEGAHERTZ

I would like to commend your honesty in the story "Vanishing Megahertz" (Trends, Inside PC Labs, September 23, 1997). Now that you've gone this far with the analysis of MHz versus actual performance on business tasks, it would be very interesting to see a chart of MHz versus performance for a wider range of machines. How about dropping back to a whole range of machines, starting at 33 MHz? Specifically, it would be interesting to get a visual notion of how and where the MHz-versus-performance chart starts dropping off. A really interesting chart would show return on investment as a function of MHz.

WARNER MACH
via the Internet

GO LOCAL

I agree and disagree with Bill Howard in his column "Freedom of Choice" in the September 23 issue. I agree with his statement that you can't always find what you want in a computer superstore. However, I disagree when he says that the only way to find your ideal PC is by calling a direct dealer. Another option for consumers is to stop at a small, local mom-and-pop computer store that will build a PC to your specifications. Such stores give much more personal service and seem to be more knowledgeable than the superstores; they also provide a place for you to bring your PC if you have a problem.

DAVE POLLACK
Rochester, New York

Howard's article concerning price cuts was good news to those of us on the verge of an upgrade. But if companies are assembling and delivering machines on the same day, that means saying good-bye to a quality diagnostic burn-in. Remember a few years ago when companies boasted a 72-hour burn-in? That was supposed to ensure that the machine worked perfectly the first time, right out of the box, throughout the warranty period and beyond. Can lower prices and quality coexist? Are we on the verge of a wave of defective, hastily assembled machines?

ROBERT W. GRACE
Evansville, Indiana

MILLENNIUM MADNESS

I just read your year-2000 (Y2K) article "Welcome to the Millennium" (PC Tech, September 23, 1997), and I'm concerned about some of its statements. Throughout, the article indicates that the rollover to the year 2000 affects "computers." The problem is not with computers or the way they maintain dates, but with programs and the way they strip the century off the year. As far as I know, all computers since the IBM PC AT have provided four digits for the year in hardware, but the programs that retrieve the dates ignore the registers containing the century.

The article also mistakenly says that "most mainframes will treat 010100 as January 1, 1900." It should have read, "Most programs written for mainframes will treat 010100 as January 1, 1900." I have worked on a number of mainframes, and all provided the century in their system-date programs. Almost every piece of software, though, stripped the century off the year before storing it in with data. I'm sure that as long as you purchase product upgrades in the three or four years before 2000, there won't be a problem.

CHRISTOPHER W. CARLSON
via the Internet

The story was interesting but didn't go far enough. What I really need to know, as MIS manager for my company, is how this problem affects my off-the-shelf software. I have seen countless articles and Web sites with information about Y2K, but they've all been from a custom-applications viewpoint, which is totally useless in our situation. We are still running Windows 3.11 and Microsoft Office Pro, Version 4.3 (of which Excel, Access, and Word may be affected). In addition, we have a few users running Lotus 1-2-3, Version 5, and WordPerfect 6. Assuming that the BIOS on each system is Y2K-compliant, I'd like to know what problems we might expect from our software—including the Windows 3.11 operating system itself.

RALPH BROWN
via the Internet

CORRECTIONS AND AMPLIFICATIONS

In the Network Edition of our October 7 issue, the illustration in the column "Multiple Access" (page NE14) should have been credited to Mark Shaver.

In the First Looks review "Affordable Desktop Power" (September 23, 1997), we incorrectly stated that the Intel 430TX chip set was the only one to support Ultra DMA. The Apollo VPX and the AMD 640 both support Ultra DMA.

HOW TO CONTACT US--1

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Trends

The Chip Challenge

IBM and Intel serve up dramatic chip-manufacturing innovations.

Moore's Law—which states that semiconductor power doubles every 18 months—has been accurate for decades, but chip makers are out to defy it with new techniques. The advancements affect all kinds of computing and consumer electronics devices, and Intel chairman emeritus Gordon Moore himself foresees a particularly dramatic short-term shot of adrenaline for handheld PCs, smart phones, and other portable devices.

Intel has announced that it has developed a memory chip technology, StrataFlash, that's designed to double the data storage capacity of each memory cell in a flash memory chip. SanDisk introduced a similar technology, DoubleDensity, several months ago. Flash memory chips are used in handheld and portable computers, cellular telephones, and telephone answering machines, among other devices. In short order, Intel engineers hope to pack such devices with twice as much data-handling muscle. Intel plans volume shipments of 64-megabit flash chips based on the advancement by the first quarter of 1998.

"Two bits in the space of one starts a new direction in memory technology," says Moore. "This will lead the way to lower cost and open up new applications." Moore expects that devices such as digital smart phones and handheld PCs will immediately become smaller, twice as capable, and cheaper.

COPPER CHIPS

IBM has announced a new technology, CMOS 7S, that aims to defy Moore's Law. The method creates silicon wafers' circuitry by combining the silicon with copper instead of with aluminum. Aluminum has been the chip-circuitry material of choice for more than 30 years, although copper is known to be a superior electrical conductor. According to IBM engineers, most chips today contain transistors that have 0.35-micron widths, but as you get down to 0.20-micron widths, aluminum's inefficiency inhibits a chip's electrons from moving fast enough.

Until now, experiments have been unable to prevent copper from bleeding into the silicon and contaminating the chip. After a decade of experiments at both IBM and Intel, IBM engineers say they have surmounted this problem.

IBM's new copper chips will show up initially in its mainframe computers early next year. The method will also be used to make PowerPC chips, which are employed in IBM's high-end RS/6000 and AS/400 lines as well as in Macintosh and Mac clone computers. The chips will run at a whopping 1 GHz, whereas today's fastest PC chips run at 350 MHz. Intel is also pursuing experiments with copper but doesn't plan to sell copper-based chips until 2002. AMD and other major semiconductor manufacturers are experimenting with copper-based chips as well. But it appears that IBM will enjoy its head start through the turn of the century.

SMALLER, CHEAPER, FASTER

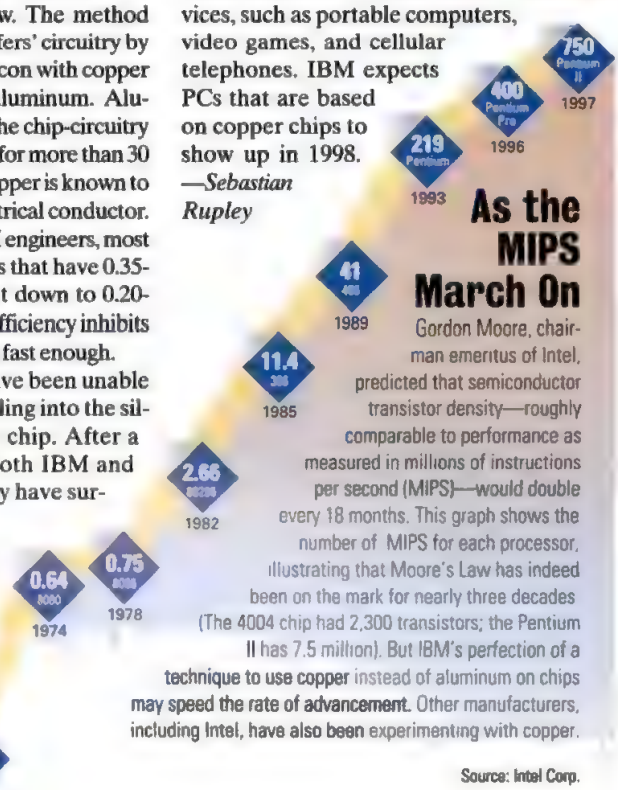
According to IBM officials, several benefits result from copper-based chips' superior conductivity. Above all, manufacturers can produce the new chips up to 40 percent more quickly than today's advanced chips. Also, copper conducts so well that chip makers can reduce circuit size beyond today's state-of-the-art 0.20-micron width, which means that manufacturing will be cheaper. IBM's announcement sent its stock up nearly 6 percent.

And smaller circuit sizes mean that copper-based chips can be used for such devices as handheld computers and cellular telephones. It's important to note that IBM's innovation promises to advance the process for all kinds of semiconductors, whereas Intel's StrataFlash applies only to flash memory–based devices, such as portable computers, video games, and cellular telephones. IBM expects PCs that are based on copper chips to show up in 1998.

—Sebastian Rupley

As the MIPS March On

Gordon Moore, chairman emeritus of Intel, predicted that semiconductor transistor density—roughly comparable to performance as measured in millions of instructions per second (MIPS)—would double every 18 months. This graph shows the number of MIPS for each processor, illustrating that Moore's Law has indeed been on the mark for nearly three decades (The 4004 chip had 2,300 transistors; the Pentium II has 7.5 million). But IBM's perfection of a technique to use copper instead of aluminum on chips may speed the rate of advancement. Other manufacturers, including Intel, have also been experimenting with copper.



Source: Intel Corp.

ILLUSTRATION BY LAMBERTO ALVAREZ

It's a Wired World

Globalization of the Web is happening—slowly but surely.

Bet you didn't know that Canada is the most wired country in the world, or that Finland has twice as many Internet-connected computers per 1,000 residents as the United States does.

Well, why would you? Since its inception, the Internet—especially the Web—has been a distinctly U.S. phenomenon: The vast majority of sites on the Web are in English, and for the most part, the U.S. is at the forefront in adopting Internet technologies such as Secure Sockets Layer and digital certificates. Industry watchers estimate the U.S. is one to three years ahead of the pack in development and use of Internet technology.

About one-third of all Internet users in the UK are female.
(Source: NOP Research Group)

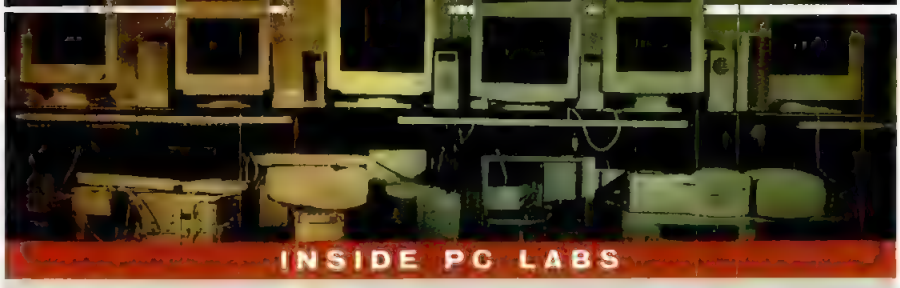
Other countries, however, aren't standing still. Several trends indicate that the Internet is expanding—albeit slowly in countries without advanced telecommunications. According to research firm International Data Corp., people outside the U.S. accounted for 23 percent of all Web users in 1995, and that number is projected to increase to about 50 percent by the end of the decade. Sales in Europe and Asia currently make up about 20 to 30 percent of all Internet software sales, according to Goldman Sachs analyst Michael Parekh.

Eight million Canadians are online.
(Source: ACNielsen)

Deregulation of the telecommunications industry outside the U.S. is one of the major forces behind the Web's globalization, according to Parekh. About 25 percent of all new *.com* domain name registrations come from outside the U.S., says Raymond Corsin, senior vice president of business development at Network Solutions.

The Internet grew 178 percent in Hong Kong in 1996, faster than anywhere else in the world.
(Source: Network Wizards)

Global electronic commerce is in its infancy, but it's showing some signs of growth. Internet booksellers Amazon.com and BarnesandNoble.com, for example, both earn about 20 percent of their revenues from international sales. But currently, the majority of consumers buying goods on the Internet outside the U.S. are English-speaking, which means there are still plenty ofuntapped markets around the world.—*Angela Hickman*



Move Your Databases to the Web—But Do It Carefully

WHAT IF YOU HAD THE CHANCE TO LET industry experts turn your corporate database program into a Web application? To find out whether today's tools can handle the job, we put PC Labs' own inventory control program on the line, inviting major database tool vendors such as Microsoft, Oracle, and Sybase to rewrite it for this issue's feature story "Web Database Development Tools: From the Ground Up." We asked the vendors to redo the program for our corporate intranet and to add whatever new features made sense for the Web version. Today, corporate applications need to make the same transition to the Web, and fast.

If you haven't done your homework, redeploying a bad design on an intranet is not going to solve anything.

Based on our experience, we think the future looks good for older applications, because the tools to bring them to the intranet are now ready. The tools we evaluated—including Apple's WebObjects, Borland's IntraBuilder, Microsoft Visual InterDev, and Oracle Web Developer Suite—did an excellent job of bringing an old-style database application to the intranet quickly.

We gave the outside programmers our client/server application—representing several months of programming over several years—along with a list of requirements for the new application, including sample forms and features and specs for the look and feel. In under a month, the Web versions were ready for our intranet.

TO REUSE CODE OR NOT

The experience got us thinking about which solutions to adopt—HTML, Java, or ActiveX—and about how to reuse code. Any software-engineering textbook will tell you that you can reuse source code, components, and even a program's design. In fact, developers loyal to traditional software-engineering practices—such as formal methods, requirements analysis, and testing and software metrics—will tell you that a project's coding aspect is typically very minor, say only 20 percent. The rest of the process—design, testing, and documentation—actually takes up most of a developer's time.

But most programmers, including those at PC Labs, don't have much time for those aspects of software engineering. Study after study reveals that programmers still wing it in that regard; most don't use software-engineering practices at all. After all, with the tools getting better and better, it's easy enough to start coding right away, without proper preparation.

At the end of testing for our Web database story, we had a lot of code to study but still hadn't nailed down our design requirements, nor did we have any error-tracking mechanisms or good documentation. And then we started to wonder whether we had made good decisions about the design and infrastructure. Sound familiar? This is undoubtedly the situation facing plenty of programmers today.

Since new Web database–programming tools make coding so easy, maybe developers will have more time for other aspects of software engineering. As our feature story suggests, that approach may lead to more useful, reusable, and maintainable software over the long term. The move to the Internet is sure to be exciting and a little stressful for developers. It's also a chance to work with your design documents and your architecture in a new setting. If you haven't done your homework, redeploying a bad design on an intranet isn't going to solve anything.
—*Richard V. Dragan*

Holographic Thinking

A Toronto company teaches PCs to learn patterns and to predict financial markets.

Computers can calculate like crazy, but can they think? Most would have to agree that a computer's thinking ability is roughly equivalent to that of a cabbage, or maybe a fly.

The human brain has over ten billion cells, and the largest cell has 200,000 inputs. With all the cells running in parallel, that adds up to trillions and trillions of connections per second. "We can run about 30 million connections per second on a PC," says John Sutherland, president of the Toronto-based AND Corp. and father of a promising technique for teaching computers how to learn. That makes a computer simulation about as smart as an insect, he explains. By focusing intensely on a single task, a computer program can perform exceptionally well.

In fact, there's a software program that can be trained to detect credit card fraud, locate mineral deposits, recognize faces, and analyze electroencephalograph patterns. AND Corp.'s HNet—whose name stands for *holographic neural technology*—can solve a wide range of problems by applying the principles of *holographic memory*, a brain-research term that refers to the idea that memory is nonlinear and multidimensional.

HNet creates digital approximations of nerve cells and stimulates them via software signals indicating intensity and frequency. Each cell can receive up to 64,000 analog inputs that are mapped to 64,000 output responses.

The result: software that simulates the human brain's cognitive functions and can deal with problems involving practically anything measurable. For instance, in a stock-prediction program, the input would be a historical market indicator, and the output would be a prediction about the market.

Sutherland says that what sets HNet apart from other neural networks is its blazing speed, which enables instant learning. "The holographic neural cell is based on a completely different realm of mathematics, operating entirely within the complex-number domain. We believe we've overcome the fundamental limits of traditional neural network technology," he adds. Such systems take a long time to train, because they're based on complex matrices of cells. In contrast, HNet learns and runs very quickly, because one cell can store thousands of patterns.

Moving neural net technology out of the research lab and into commercial applications is one problem that no artificial brain has solved yet. Sutherland hopes to license HNet and participate in joint ventures to build applications in areas ranging from speech recognition to cardiac postoperative care.—*Carol Levin*

JAKE KIRCHNER

Food for Thought About Internet Advertising

Anyone who buys groceries from a reasonably modern market has experienced this bit of personalized advertising. You pay for your milk, eggs, Minute Maid orange juice, and the rest of your foodstuffs, and when you get home you find in the bag a coupon for Tropicana juice that says something like, "Did you know that Tropicana has 25 percent more vitamin C than Minute Maid? Use this coupon to get 50 cents off your next half-gallon of Tropicana Pure Premium."

Of course Tropicana knows that the coupon is going to a Minute Maid buyer, because that information was scanned into the store's checkout system, which spit out the coupon when it printed your register receipt and credit card slip. Tropicana can afford to offer you a nice rebate, because the company has saved a ton of money by being able to target you, a prime potential customer, without mailing millions of coupons to people who might never drink orange juice.

Pretty nifty use of technology. And pretty harmless. Or maybe not. Think of the possibilities if some database somewhere were to track everything you buy. It's unlikely any single database—other than your credit card company's—will have significant amounts of information about your purchases. But it's not farfetched to imagine databases being linked across the Internet for a detailed profile of your buying preferences.

Even today there are companies that can deliver targeted ads to your e-mail address or, in real time, to your Web browser based on the sites you're visiting. Privacy and security on the Web are hot topics. Many parties are working to secure Web transactions, and there are multiple schemes for limiting the personal information we pass along. But not as much thought is being given to the legitimate but ancillary uses of the data that we volunteer or that we inadvertently provide by buying something online.

Advertisers are willing to pay big bucks for such buyer access. According to International Data Corp., the business transacted over the Web is expected to grow from $2.6 billion last year to over $220 billion during 2001.

You can't buy on the Web without revealing personal info. You don't just buy airline tickets; you specify the person you're buying them for. You don't just buy flowers; you specify the recipient and the occasion. When you buy books, videos, and CDs, you reveal a great deal about your preferences—far more than you realize, because that information can be combined with census-type data to build a very accurate profile.

It's one thing to have BarnesandNoble.com alert you to the next thriller in a series you've been following, but think how you'll feel when Departmentstore.com e-mails you a message that says, "Hey, big spender, it's your anniversary. The little lady will appreciate the diamond pin that's 20 percent off this month. After the toaster oven you got her last year, don't you think she deserves it? And don't make us send her an e-mail about the pearl earrings you had us deliver to that young thing in your accounting department!"

You think Internet ads are annoying now? Wait till they start getting personal!

ILLUSTRATION BY MILAN TRENC; PHOTOGRAPH BY SHONNA VALESKA

Sorry, kitchen sink not included.

You want the best of all worlds. And now you can have it. With an NEC Versa 2700 Series notebook. It features the all-in-one convenience of a built-in CD-ROM, battery and floppy drive. (What would you expect from the people who invented the notebook computer in the first place?)

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- 133MHz Pentium processor with MMX technology
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- 56Kbps* Capable Integrated Modem
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- * Upgrade to 3.2GB Hard Drive, add $249
- * Lithium Ion Battery, add $199
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Versa Add Ons:
* VersaNote™ Ballistic Nylon Compact Carrying Case, add $59
* VersaExec™ Leather Carrying Case, add $199
* NEC Xircom 10Base-T Network PC Card, add $99
* Spare AC Adapter, add $89
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Versa 6230

- 233MHz Pentium Processor with MMX technology
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- Upgrade to 96MB RAM, add $699
- Upgrade to 5GB Hard Drive, add $499
- * 2nd Lithium Ion Battery, add $199
- * Versa Docking Station 6000 Plus, add $869
- * Upgrade to UltraCare Extended Service, add $199

$3999
Business Lease: $140/mo.
Code # V6231

Versa 6220

- 200MHz Pentium Processor with MMX technology
- **13.3" XGA Active Matrix TFT Color Dispay**
- **32MB EDO DRAM (128MB max)**
- **2.1GB Hard Drive**/20X max Variable Speed CD-ROM
- * Upgrade to 64MB RAM, add $299
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- * Upgrade to UltraCare Extended Service, add $199

$3699
Business Lease: $129/mo.
Code #V6220

Versa 6200MX

- 166MHz Pentium processor with MMX technology
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Code #V6202

Direction Add Ons:
* DirecPC Satellite Dish, add $299
* 3COM 3C905-TX 10/100 PCI, add $80
* 2nd Year On-Site Service (with purchase of system), add $59
* 2nd and 3rd Year On-Site Service (with purchase of system), add $99

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* NEC Xircom 10/100 CardBus Network Card, add $159

$3299
Business Lease: $119/mo.
Code #V6063

Versa 6050MH

- 150MHz Pentium processor with MMX technology
- 12.1" SVGA Active Matrix TFT Color Display
- **16MB EDO DRAM (80MB max)**
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- 33.6Kbps*, Cellular-Ready Integrated Modem
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* Upgrade to 32MB RAM, add $159
* Upgrade to 3.2GB Hard Drive, add $249
* 2nd Lithium Ion Battery, add $199

$3199
Business Lease: $115/mo.
Code #V6053

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Direction SPL300

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- ATX Motherboard with 440LX AGPset
- Number Nine Reality 334 AGP, 4MB SGRAM
- Altec® Lansing ACS-90 Speakers
- NEC C700™ 17" Monitor (16" viewable)

* Upgrade to Number Nine Revolution 3D AGP, 4MB WRAM, add $219
* Iomega Zip Drive, add $99

$2679
Business Lease: $96/mo.
Code #D5026

Direction SPT233

- 233MHz Pentium processor with MMX technology
- **64MB SDRAM**
- **6.4GB Ultra DMA Hard Drive**
- ATX Motherboard with 430TX PCIset
- Number Nine Revolution 3D PCI, 8MB WRAM
- Altec Lansing ACS-45 Speakers
- Creative Labs AWE32 Wavetable Audio
- Iomega® Zip Drive
- U.S. Robotics x2 56Kbps* Capable Modem
- NEC C700 17" Monitor (16" viewable)

* Upgrade to NEC MultiSync® A700 17" Monitor (15.6" viewable), add $199

$2799
Business Lease: $101/mo.
Code #D5020

Direction SPL266

- 266MHz Pentium II processor
- **32MB SDRAM**
- **4.3GB Ultra DMA Hard Drive**
- ATX Motherboard with 440LX AGPset
- Number Nine Reality 334 AGP, 4MB SGRAM
- Altec Lansing ACS-90 Speakers
- NEC C550 15" Monitor (14" viewable)

* Upgrade to Yamaha Wavetable Audio, add $49
* Upgrade to NEC C700 17" Monitor (16" viewable), add $219

$2029
Business Lease: $73/mo.
Code #D5028

Direction SPT200

- 200MHz Pentium processor with MMX technology
- **32MB SDRAM**
- **3.2GB Ultra DMA Hard Drive**
- ATX Motherboard with 430TX PCIset
- Number Nine Reality 334 PCI, 4MB SGRAM
- Altec Lansing ACS-90 Speakers
- U.S. Robotics x2 56Kbps* Capable Modem
- NEC C550 15" Monitor (14" viewable)

* Upgrade to Creative Labs AWE32 Wavetable Audio, add $49
* Upgrade to NEC C700 17" Monitor (16" viewable), add $219

$1669
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DESKTOP PCS

The Growing Allure of DVD

Touted as the heir apparent to the CD-ROM, DVD is gradually gaining a presence in the mainstream PC market. Discs and drives using this fledging storage technology take up no more physical space than their CD-ROM counterparts, but they store and read much larger amounts of data. The first single-sided DVD-ROM disks have 4.7GB capacities, roughly seven times that of a standard CD-ROM.

Such capacity provides software developers with much-needed space for titles that would otherwise span multiple CD-ROMs. More importantly, it brings personal computers closer to the home electronics market. DVD, which allows for a full-length feature film to be stored on a single disk, has the potential to replace VHS and laserdiscs as well as CD-ROM drives. Backward compatible with existing audio, video, and computer CD formats and DVD movie disks, the DVD-ROM drive will also read the new breed of computer applications that are fast becoming available on DVD-ROM.

Gateway 2000 (800-846-2000. *www.gateway.com*), the leading direct seller of home PCs, offers the Toshiba SD-M1002—the first DVD-ROM drive to arrive on the market last November—as a $199 option on all of its build-to-order machines. The drive also ships standard with the company's PC/TV model, the Destination, and its 300-MHz Pentium II desktop, the G6-300 XL.

If ever there was a system meant for your living room, the $4,699 **Gateway Destination D6-300** and its 31-inch SVGA monitor are it. Designed to be used in lieu of a home-theater system, this 300-MHz Pentium II PC comes with 64MB of EDO DRAM, an 8.4GB hard disk, and a 56.6-Kbps TelePath x2 modem. The system integrates a cable-ready TV tuner with its STB graphics solution, which is bolstered by 2MB of EDO DRAM. For computing from the family couch, there's a wireless keyboard and mouse. Audio is provided by a hi-fi wavetable audio card and a Harman/Kardon High-Fidelity speaker system.

VERSATILITY: *Systems with DVD-ROM from Gateway 2000 (the Gateway Destination D6-300, above, and the Gateway G6-300XL, right) and ProGen Systems (below).*

The $3,799 **G6-300XL**, which is equipped with a TV/FM tuner card, can also double as a television. Unlike the Destination, however, it uses a 19-inch monitor and an nVidia AGP graphics accelerator with 4MB SGRAM. The base components of the system are similar to the Destination—300-MHz Pentium II CPU and 8.4GB hard disk. The system also includes 64MB of SDRAM, an Ensoniq wavetable sound card, Boston Acoustics MicroMedia speakers, and a 56.6-Kbps TelePath modem.

Micron Electronics (888-634-8799, *www.micronpc.com*) provides the Micron-manufactured MEI DVD II drive as standard on its $3,648 **Millennia XKU 266** with Fusion 3D desktop. It also comes as a $599 option on the $2,799 **Millennium MME with Fusion 3D**. Fusion 3D is shorthand for Micron's entertainment bundle, which features a sound card, joystick, speakers, and such popular 3-D games as MECH Warrior 2: Mercenaries and Command and Conquer. The XKU 266 complements its Fusion 3D solution and DVD drive with a 266-MHz Pentium II processor, 64MB of SDRAM memory, a 6.4GB hard disk, an Iomega Zip drive, and a 17-inch Micron monitor. A Diamond Stealth nVidia Viper V330 AGP 128-bit video card with 4MB of SGRAM and MPEG controls the 2-D and 3-D graphics on the XKU. Audio is piped through the Creative Labs AWE64 wavetable sound card to the system's Cambridge SoundWorks speakers and subwoofer.

The less-expensive **MME with Fusion 3D** is outfitted with a 233-MHz Pentium with MMX Technology, 48MB of SDRAM, a 4GB IBM hard disk, a Zip drive, a 17-inch Micron monitor, a 56.6-Kbps U.S. Robotics x2 modem, integrated 32-bit wavetable audio, and two Advent stereo speakers. The MME achieves optimal 2-D and 3-D graphics performance thanks to the boost from the Monster 3-D graphics card with 4MB of memory and the Diamond Stealth Pro DX with 4MB of EDO and MPEG memory.

ProGen Systems (800-848-1353, *www.progen.com*) includes Pioneer's DVD drive, the DVD-101, as standard equipment with its **Pentium II/266** mini-tower, the **Polaris 266 W95**. This $2,700 266-MHz Pentium II CPU also includes the Sigma Design RealMagic Hollywood MPEG-2 decoder, a GVC Media Technology SP 802 PCI audio card, a pair of MLi stereo speakers, and a 17-inch Panasonic monitor. In spite of all this power, the core of the system is moderately adept: 32MB of SDRAM, a 6.7GB Maxtor hard disk, and a Matrox Millennium II AGP graphics solution with 8MB WRAM. ProGen also bundles a 56.6-Kbps Archtek modem, but it is the only system discussed here that doesn't bundle any noteworthy software titles.

From Digitron Micro Solution (888-708-2800; *www.digitronpc.com*) comes the **HT3000 Pentium** system, which includes Toshiba's SD-M1002 drive, and the HT-3000's SSI MTS-100 Surround Sound Home Theater speaker system, which has five speakers and a subwoofer.

The $3,249 machine, a 266-MHz model, is also outfitted with 32MB of EDO DRAM, a 6.4GB IBM hard disk, an STB Nitro 3D graphics adapter (6MB of DRAM), a Creative Labs Sound Blaster audio card, a U.S. Robotics 33.6-Kbps modem (upgradable to 56.6-Kbps), a 17-inch CyberVision monitor, and a Cirque Input monitor with a touchpad that can capture signatures via a stylus pen.—*Cade Metz*

MAPPING SOFTWARE

Finding Your Way

Unveiling the latest generation of street-level mapping software are DeLorme (800-452-5931, *www.delorme.com*), Microsoft Corp. (800-426-9400, *www.microsoft.com*), and Rand McNally (800-671-5006, *www.randmcnally.com*)—the three major players in the mapping-software market.

Although they each include information that will be of interest to those taking leisure trips, vacation planning is not the raison d'être of these packages. Instead, these products are designed to get you where you want to go, mapping your itinerary based on your origin, destination, and specified stops along the way.

DeLorme's **Street Atlas USA 5.0 Deluxe Edition** packs an arsenal of new features. The $45 (street) product not only helps you plot your route from point-to-point, but it now offers address-to-address routing as well. Among the new features is the ability to choose roads you'd like to avoid for a given itinerary. One-way streets are now identified on the maps of 100 major cities. You can also add customized tags to mark things like one-way streets or no-left-turn signs. Anyone who has driven in unfamiliar territory will appreciate Street Atlas's driver-friendly information, including exit service data for all U.S. interstate exits and local radio listings. Once you have your itinerary set, you can then print out complete travel plans, directions, maps and summaries.

Even though Street Atlas is not primarily a tourism product, it does offer enough travel information to be useful to those planning vacation getaways. There is a selection of scenic drives for locations across the country and a database of two million businesses and points of interest.

Street Atlas can be used with any GPS (global positioning satellite) receiver; by using a special cable, you can downlowad route directions to your U.S. Robotics PalmPilot hand-held device. Street Atlas also features a weather almanac and the ability to make online hotel, airline, and car-rental reservations via links to Travelocity. In addition, it lets you view census demographic data by clicking on an area's zip code. Simply Streets USA, a scaled-down version of Street Atlas, focuses strictly on street-level mapping. It is available for $20 (street).

Microsoft Expedia Streets 98 Deluxe Edition ($70 street) has improved in both its look and feature set. This reincarnated version of Microsoft Automap Streets Plus has received a complete face-lift, simplifying the interface and making the highly detailed maps easier to read.

The improved address-matching and mapping capabilities are bolstered by 6 million miles of road data for 150,000 cities and towns. Also, an optimized algorithm helps you find what you're looking for.

Packed with content, Expedia Streets features Zagat Survey for restaurant tips, the Expedia Hotel Directory (a CD-based version of Expedia's Web site database, which lists over 19,000 hotels, motels, and bed and breakfasts), and 650,000 points of interest. Expedia Travel Agent links to the Expedia Web site for booking air, hotel, and car reservations. You can export your maps and directions to hand-held Windows CE devices running Pocket Streets as well ten different GPS receivers.

The Deluxe Edition comes with American Business Information's Yellow Pages USA. This Expedia-specific version is integrated into Expedia Streets, so you can locate the CD-ROM's business listings on Expedia maps. The Standard Edition, which lacks the Yellow Pages, sells for $50 (street).

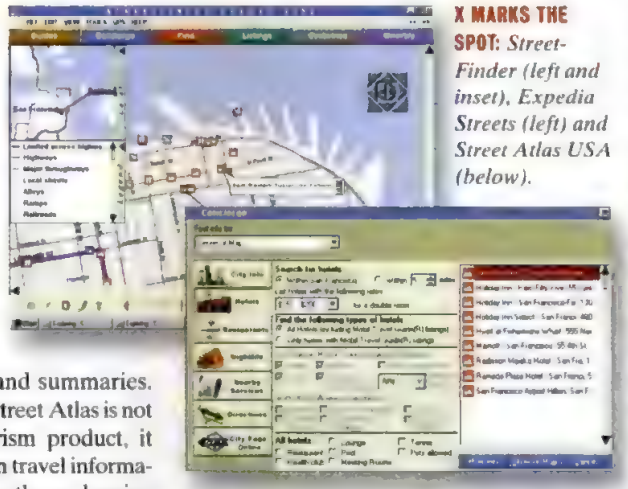
Rand McNally takes its **StreetFinder Deluxe 1998 Edition** ($45 street price) to the next level by including address-to-address directions. The company takes a different approach, however, by offering this feature via an Internet connection to its Web site database.

StreetFinder's interface has now been streamlined to improve usability. A set of five buttons replaces the previous array of difficult-to-identify toolbar buttons. You can also better customize your maps by using the improved annotation tools.

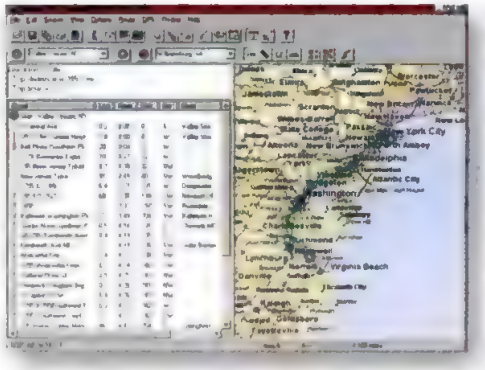
The food and lodgings database has been expanded and updated, so you can now search for specific restaurant chains or cuisine types. There are 17,000 business and attractions listings that can be pinpointed on StreetFinder's maps as well.

In addition to Rand McNally's database, StreetFinder Deluxe has a total of 29,000 restaurant and accommodation listings from the ever-popular Mobil Travel Guide. The Mobil data is integrated into StreetFinder, so you can locate any of the establishments listed in the Mobil Travel Guide on the maps themselves. The Concierge button gives you immediate access to local information and recommendations for 100 domestic travel destinations.

There is also support for GPS systems. And thanks to a partnership with the Internet Travel Network and Worldview Systems, you can make airplane and hotel reservations via Rand McNally Online. A Standard Edition ($25 street)—which lacks GPS support, the Mobil Travel Guide, and Concierge data—is also available.—*Melissa J. Perenson*



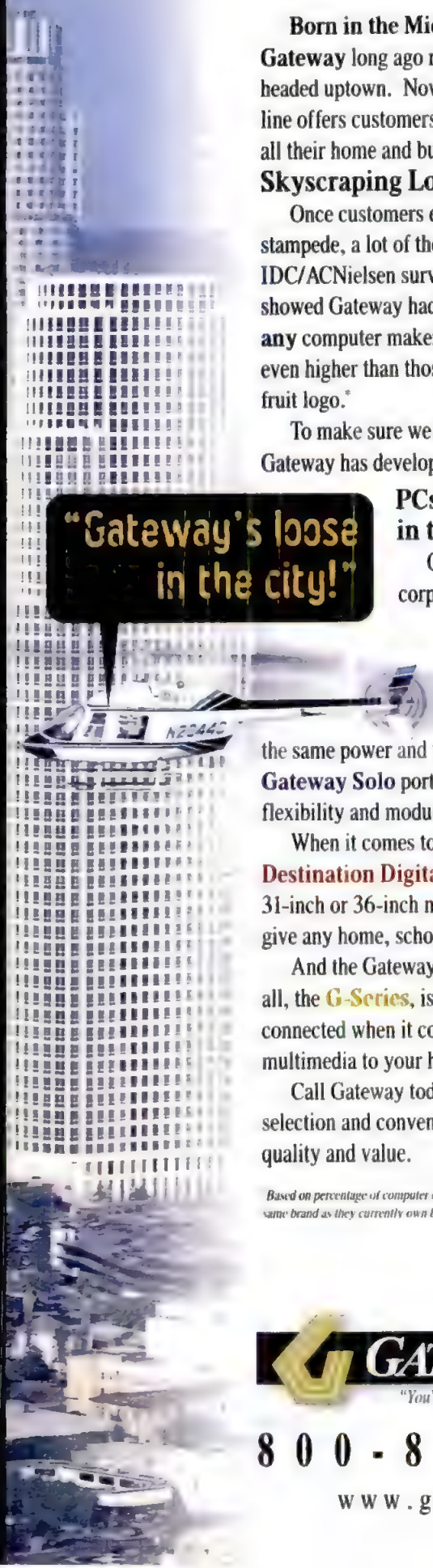
X MARKS THE SPOT: *StreetFinder (left and inset), Expedia Streets (left) and Street Atlas USA (below).*



REGAP First Looks reviewed four travel planners in the *PC Magazine* issue of October 21, 1997. We awarded our Editors' Choice award to Rand McNally TripMaker 98. For reviews of GPS units from Chicago Map and Etak, check out First Looks, July 1997.

"It's no accident, folks."
GATEWAY2000

MMX
intel inside
pentium II



Born in the Midwest 12 years ago, Gateway long ago rampaged past the suburbs and headed uptown. Now Gateway's huge product line offers customers everywhere one address for all their home and business computing needs.

Skyscraping Loyalty

Once customers experience the Gateway stampede, a lot of them come back again. An IDC/ACNielsen survey of computer owners showed Gateway had the highest brand loyalty of **any** computer maker in the U.S. home market, even higher than those West Coast guys with the fruit logo.*

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Our **E-Series** line rules the corporate high-rise with smart PCs ready for the network and the business muscle of workstations and servers. Our **GP-Series** PCs deliver the same power and value to small business while **Gateway Solo** portable PCs brim with speed, flexibility and modularity and are born to run.

When it comes to group computing the **Destination Digital Media Computer's** 31-inch or 36-inch monitors (35.5-inch viewable) give any home, school or office a great view.

And the Gateway product line that started it all, the **G-Series**, is street-smart and well-connected when it comes to delivering fresh multimedia to your home.

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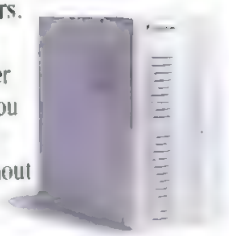
Take a look at these glittering values and give us a call today.

GATEWAY™ NS-Series Servers

Gateway moves upstairs to the executive suite with three new tower models as durable as New York's mountainous skyscrapers. Our NS-Series servers' fault-tolerant options include error-correcting memory systems, RAID storage and redundant power supplies. An InforManager™ manageability subsystem alerts you if a component needs attention. Gateway servers are the main engines to power your business productivity into overdrive without the 100-story margins traditionally built into servers.

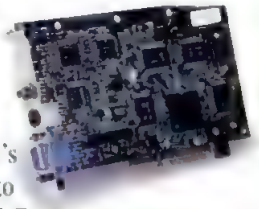


Gateway E-Series Workstations

Gateway's workstations are built for your business's heavy lifting. With **Pentium II** processors running on a high-octane Microsoft® Windows NT® operating system, you're at the controls of a machine that can reign in complex data and execute processor-busting feats faster than you can make lunch plans. And, as with our server line, Gateway brings workstation margins down from the penthouse to the ground floor.

Accelerated Graphics Port (AGP)

Creating amazing graphics on your PC screen used to take a lot of memory on your graphics accelerator card. AGP, the next-generation graphics system developed by Intel, transfers some video memory functions to the system's memory. That lets your video card widen the flow of data to the monitor, creating smooth, fast video and sophisticated 3-D performance. It's like adding four lanes to your video data highway for the price it takes to paint the center line.

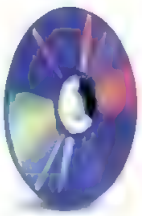


Destination™ Digital Media Computer

In April 1996, the Gateway Destination Big Screen PC/TV pioneered the PC category that merges television and computer technology. Now the bright light in the convergence category gets brighter with the second-generation Destination Digital Media Computer. The system comes with an even bigger screen — an enormous 36-inch monitor (35.5-inch viewable). The pristine digital picture of DVD on a huge digital monitor: Video nirvana.

DVD (Digital Versatile Disc)

The new star shooting up the PC charts is called DVD, initials destined to be as recognizable as "LA" very soon. Start with its amazing capacity: seven times as much as a CD and room enough for up to 133 minutes of video. And comparing analog video tape to DVD video is like comparing Broadway theater to a 3 a.m. infomercial. Add in the fact that DVD-ROM drives can play most of your existing software and audio CDs and a future superstar is born.



MMX™ intel inside pentium® II

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HIGH RISE VALUE

Gateway can meet all the needs of your enterprise with servers, desktop systems and workstations. We custom build and configure systems to meet each customers' unique requirements and sink total cost of ownership into the subway.

E-Series Desktops and Workstations

From our low-cost, network-ready E-1000 desktop to our powerful **Pentium® II** processor workstation, GATEWAY™ E-Series desktop options can boost your business.

E-Series desktop features include Desktop Management Interface (DMI)-Compliant PCs with Intel LANDesk Client Manager, easy open cases and a dedicated team of sales and technical support pros standing by to meet your needs.

Our workstations deliver the business muscle you need, using the **Pentium II** processor and Accelerated Graphics Port (AGP) for graphics-intensive applications. Just tell us what you need and we'll get out of our chairs and make it happen.

NS-Series Servers

With three models to handle your workgroup, department or entire enterprise, our server product line feels right at home inside Chicago's lake-front skyscrapers. Our NS-Series servers' fault-tolerant features include optional redundant power supplies, serviceability features and error-correcting memory to help safeguard your data.

Besides all the redundant critical components, the InforManager manageability subsystem uses 30 integrated sensors to monitor temperature, voltage, fan, power supplies and software to let you know if anything needs attention.

Give your Gateway Major Accounts representative a call and let us take your business to the top floor.

E-Series PCs For Business

Gateway E-Series PCs

- Intel Pentium® with MMX™ Technology or **Pentium®** II Processors
- High-Performance SCSI, EIDE or Ultra ATA Hard Drives
- 2-D or 2-D/3-D Video Adapters
- Pre-installed High-Bandwidth Network Options
- E-Series Low Profile, Desktop or Mid-Tower Case
- Pre-loaded with Microsoft® Windows® 95 or Windows NT® Workstation 4.0
- Hardware Management Features
- Desktop Management Interface (DMI) 1.1 Compliant
- Gateway Gold™ Service and Support for E-Series PCs••

Prices starting at **$979** *(Quantity 1)*

Gateway NS-Series Servers

- Intel Pentium® Pro or **Pentium II** Processors
- A Full Range of Solutions with up to 6-Way Processor Support
- Pre-installed High-Bandwidth Network Options
- InforManager™ Subsystem for Server Management
- Variety of High-Performance Storage Solutions Including Hot-Swappable Internal RAID on some models

Prices starting at **$2499**

Gateway Workstation E-5000

- Intel® 266MHz **Pentium II** Processor with 512K Cache
- 64MB SDRAM
- **EV900 .26 Screen Pitch 19" Monitor (18" viewable)**
- AccelGraphics Permedia™ 2 AGP with 8MB SGRAM
- 4GB SCSI Hard Drive
- 12X SCSI CD-ROM & 3.5" Diskette Drives
- 3Com® PCI 10/100 Ethernet Adapter
- MS® Windows NT Workstation 4.0
- Intel LANDesk® Client Manager 3.01

$3599 Business Lease $132/mo.

- Intel 300MHz Pentium II Processor with 512K Cache, 128MB SDRAM, 9GB Hard Drive

$5199 Business Lease $186/mo.

••E-Series PCs are covered by a three-year limited warranty. Length and type of service vary by product. Call or write for details and a free copy of our limited warranty.

Gateway Extras

(Available only with system purchase.)

- 16-Bit Token Ring Adapter **$109**
  3Com PCI 10/100 TP Adapter **$14**
  (both upgrades from ISA TPO 10BASE-T Adapter)
- MS Windows NT Workstation 4.0 Upgrade **$99**
  (upgrade from PCs that include MS Windows 95)
- 9GB SCSI Hard Drive with 10,000 RPM *(Call for upgrade pricing.)*
- 19" Hitachi® Workstation Monitor *(18" viewable)* **$899**
- 21" Hitachi Workstation Monitor *(20" viewable)* **$1199**
  (Hitachi monitor case color differs slightly from Gateway workstation case.)

Please call for current pricing on RAM and other upgrades.

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STAY MOBILE

The Gateway Solo portable PC line is ready for the tray table, taxi, den, kitchen, field or conference room — wherever your road leads.

Speed Limit? What Speed Limit?

Gateway grabbed a cab, cut through processor rush-hour traffic and mountain biked over some suburban obstacles to do the deal: 200MHz and 233MHz Intel Pentium® processors with MMX™ Technology for our mobile customers. All at prices that *may* make you wonder if the whole deal is legit.

Uptown Options

Our flagship Gateway Solo 9100 portable was built with one word in mind: features. The result is a portable that can take care of business as well as your desktop system and still come along on road trips. Common docking stations for all our Gateway Solo portable PCs let you turn any portable into a desktop.

Looking for a classic portable with high quality at a low price? Check out the Gateway Solo 2300 portable. It's a lot of computer for not a lot of money and perfect for the budget conscious or as a compliment to a desktop PC.

Under Construction

No pre-built portables here. Gateway builds every mobile and desktop PC fresh, only after a customer orders it. And, thanks to common modularity, your IS department can buy a supply of components that work in both the 2300 and 9100.

When it comes to fresh technology, common modularity and choices, Gateway is as refreshing as an open road with a tail wind.

Gateway Solo™ Portable PCs

2300SE

- 12.1" SVGA DSTN Color Display
- Intel® 133MHz Pentium® Processor
- 16MB SDRAM (expandable to 192MB)
- 256K Pipelined Burst Cache
- 128-Bit Graphics Accelerator w/ 64K Colors
- Modular 6X min/11X max CD-ROM Drive
- Modular 3.5" Diskette Drive
- USB Ports & Zoomed Video
- NTSC/PAL Video Output
- 2GB Hard Drive
- 16-Bit Sound & Stereo Speakers
- NiMH Battery & AC Pack
- 85-Key MS® Windows® 95 Keyboard
- EZ Pad® Pointing Device
- Casual Carrying Case
- Microsoft® Windows 95
- MS Works 95
- Gateway Gold™ Service & Support for Portable PCs

$1999 As low as* $70/mo.

2300LS

- 12.1" SVGA TFT Color Display
- Intel 200MHz Pentium® Processor with MMX™ Technology
- 32MB SDRAM (expandable to 192MB)
- 256K Pipelined Burst Cache
- 128-Bit Graphics Accelerator w/ 64K Colors
- Modular 6X min/11X max CD-ROM Drive
- Modular 3.5" Diskette Drive
- USB Ports & Zoomed Video
- NTSC/PAL Video Output
- 3GB Hard Drive
- 16-Bit Wavetable Sound & Stereo Speakers
- PC Card 33.6 Data/14.4 Fax Modem**
- 12-Cell Lithium-Ion Battery & AC Pack
- 85-Key MS Windows 95 Keyboard
- EZ Pad Pointing Device
- Casual Carrying Case
- MS Windows 95 & MS Office 97, Small Business Edition plus Encarta® 97
- Gateway Gold Service & Support for Portable PCs

$3849 As low as* $134/mo.

9100XL BEST BUY

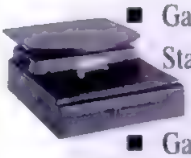
- **13.3" (1024 x 768 resolution) XGA Color Display**
- Intel 233MHz Pentium Processor w/ MMX Technology via Intel's Mobile Module (I.M.M.) Package
- 64MB SDRAM (expandable to 192MB)
- 256K Pipelined Burst Cache
- **4MB EDO Video RAM (1280 x 1024 external)**
- **Removable Combo 6X min/11X max CD-ROM & 3.5" Diskette Drive (allows for second battery pack)**
- USB Ports & Zoomed Video
- NTSC/PAL Video Input & Output
- 5GB Hard Drive
- 16-Bit Wavetable Sound & Yamaha Stereo Speakers
- PC Card Modem with x2 Technology**
- Two 12-Cell Lithium Ion Batteries & AC Pack
- External Battery Charger
- Full 88-Key MS Windows 95 Keyboard
- EZ Pad Pointing Device
- 15-Pin MIDI/Game Port
- Executive Carrying Case
- Gateway Solo Mini Docking Station
- MS Windows 95 & MS Office 97, Small Business Edition plus Encarta 97
- Gateway Gold Service & Support for Portable PCs

9100XL $5699 As low as* $198/mo.

9100SE *(Intel 150MHz Pentium processor with MMX Technology, 2GB Hard Drive, 16MB SDRAM, MS Works 95, One Lithium Ion Battery, and Casual Case. Excludes Docking Station, External Battery Charger and Modem.)* **$3299** As low as* $115/mo.

Gateway Extras

(Some items only available to new or existing Gateway customers or with the purchase of a system.)



- Gateway Solo Docking Station **$599**

- Gateway Solo Mini Docking Station **$199**
- Additional 2300/9100 Lithium Ion Battery **$200** *(with system purchase)*
- Canon® BJC®-80 Color Bubble Jet Printer **$299**
- Auto/Airline Adapter **$99**

Please call for current pricing on RAM and other upgrades.

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Gateway Solo Portable PCs For The Road

ALL ROADS MERGE AT THE BIG SCREEN

Embrace the digital future of entertainment and information with the Destination Digital Media Computer. This second-generation Big Screen PC/TV converges digital technologies into one system that leaves your traditional home entertainment system in the dust.

The Big Gets Bigger

Take your pick between 31-inch and 36-inch (35.5-inch viewable) SVGA color monitors. Digitally enhanced television performance provides dazzling broadcast images. Keep the Destination DMC traffic flow under control with the cordless keyboard and Field Mouse remote that make this system perfect for the classroom, family room and every room in between.

DVD On-ramp

Digital Versatile Disc (DVD) is here! With technology that can hold up to 133 minutes of crystal-clear video on one disc, DVD is the heir apparent to CD-ROM and maybe even VCR tape. The Destination DMC's huge monitor is the perfect playground for showing the growing number of major motion pictures now available on DVD. To help make it all come alive, we offer the Apocalypse 3Dx high-end graphics accelerator worthy of DVD's pristine signal.

Call us today to see how you can combine a DVD-ROM drive, **Pentium® II** processor and Apocalypse 3Dx graphics accelerator for your own eight-lane digital entertainment highway.

Gateway Destination D6-300XL Digital Media Computer with harman/kardon speakers

GATEWAY™ Destination™ Big Screen PC/TVs

D5-166

- Intel® 166MHz Pentium® Processor with MMX™ Technology
- 32MB SDRAM
- 512K Pipelined Burst Cache
- Destination 31" SVGA Monitor
- 2MB Graphics Accelerator w/ Cable-Ready TV Tuner
- 2GB 11ms Ultra ATA Hard Drive
- 12X min/24X max CD-ROM & 3.5" Diskette Drives
- Ensoniq® Wavetable Audio
- **Boston Acoustics® MicroMedia™ Speakers**
- TelePath® Modem *for Windows* with x2™ Technology
- 7-Bay Charcoal-Colored PC Case
- Cordless Keyboard w/ Integrated EZ Pad® Pointing Device
- Cordless Field Mouse® Remote
- Microsoft® Windows® 95
- Home Software Titles
- Gateway Gold™ Service & Support◆ for Big Screen PC/TVs

D5-166 $2499 As low as* $87/mo.

D5-200 BEST BUY *(Intel 200MHz Pentium Processor with MMX Technology, 4GB Hard Drive, DVD-ROM Drive and DVD Decoder Card)*

$2999 As low as* $104/mo.

D6-233

- Intel 233MHz **Pentium® II** Processor with 512K Cache
- 64MB EDO DRAM
- Destination 31" SVGA Monitor
- 2MB Graphics Accelerator with Cable-Ready TV Tuner
- 4GB 11ms EIDE Hard Drive
- **DVD-ROM Drive & DVD Decoder Card**
- 3.5" Diskette Drive
- Ensoniq Wavetable Audio
- **harman/kardon® High-Fidelity Sound System**
- TelePath Modem *for Windows* with x2 Technology
- 7-Bay Charcoal-Colored PC Case
- Cordless Keyboard w/ Integrated EZ Pad Pointing Device
- Cordless Field Mouse Remote
- MS® Windows 95
- Home Software Titles
- Gateway Gold Service & Support◆ for Big Screen PC/TVs

$3999 As low as* $139/mo.

◆*The Destination 31-inch and 36-inch monitors are covered by a one-year limited warranty. Call or write for a free copy.*

Gateway Destination DMC

D6-300XL

- Intel 300MHz **Pentium II** Processor with 512K Cache
- 64MB EDO DRAM
- Destination 36" SVGA Monitor (35.5" viewable)
- 4MB Apocalypse™ 3Dx Graphics Accelerator
- 2MB Graphics Accelerator with Cable-Ready TV Tuner
- 8.4GB 8.5ms EIDE Hard Drive
- **DVD-ROM Drive & DVD Decoder Card**
- 3.5" Diskette Drive
- Ensoniq Wavetable Audio
- **harman/kardon High-Fidelity Sound System**
- TelePath Modem *for Windows* with x2 Technology
- 7-Bay New-Look Charcoal-Colored PC Case
- Cordless Keyboard w/ Integrated EZ Pad Pointing Device
- Cordless Field Mouse Remote
- MS Windows 95
- Home Software Titles
- Gateway Gold Service & Support◆ for Digital Media Computers

$4999 As low as* $174/mo.

Gateway Extras

(Some items only available to new or existing Gateway customers or with the purchase of a system.)

- Additional Destination 31-inch SVGA Color Monitor **$849** *(call for details)*
- EasyPhoto Drive™ Photo Scanner **$129** *(with system purchase)*
- Epson® Stylus® COLOR 600 Ink Jet Printer **$299**

- Epson PhotoPC™ 500 Digital Camera **$399**

Please call for current pricing on RAM and other upgrades.

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Destination Big Screen PC/TVs For Grand Computing

HANDLING YOUR TRAFFIC

Looking for a computer that has the brute power, fresh technology and versatility you need to handle small business traffic? How about network options? The GP-Series PCs can deliver order to data chaos at prices that won't cause a budget detour.

Fresh Technology for the Digital Jungle

Here's some power: **Pentium® II** processor-based system including an 8MB graphics accelerator optimized for Windows NT. This one system can juggle massive data chunks and handle your complex graphics applications like computer-assisted design and architecture without breaking a 3-D sweat. Among your options is a dual **Pentium II** processor-ready system. Add the second processor right away or upgrade later as your business computing needs grow.

Our customers let us know that they wanted easy-access cases for small and medium business and we listened. The GP-Series desktop and mid-tower cases have sliding panels secured by thumbscrews. No tools required. All the GP-Series PCs' open external drive bays are industry standard sizes.

Cut Through Data Gridlock

From muscle machines to low-cost desktops perfect for your small network, the GP-Series has the technology to get it done. Just tell us where you want to go and we'll plot the course, lay out your component options and help you make the choices.

We build GATEWAY™ PCs one at a time, and only after customers have ordered them. Call us today and let our combination of great technology, amazing value and custom configurations help get you where you're going.

Gateway GP-Series professional systems offered in your choice of mid-tower and desktop models

Gateway GP-Series PCs for the Office Professional

GP5-166

- Intel® 166MHz Pentium® Processor with MMX™ Technology
- 32MB SDRAM
- 512K Pipelined Burst Cache
- EV500 .28 Screen Pitch 15" Monitor (13.9" viewable)
- 2MB 3-D 64-Bit PCI Graphics
- 2GB 11ms Ultra ATA Hard Drive
- 12X min/24X max CD-ROM & 3.5" Diskette Drives
- GP-Series Desktop Case
- 104+ Keyboard & MS® IntelliMouse™
- Microsoft® Windows® 95 & MS Office 97, Small Business Edition plus Encarta® 97
- Gateway Gold™ Service & Support for GP-Series PCs

$1399 Business Lease* $52/mo.

GP5-200

- Intel 200MHz Pentium Processor with MMX Technology
- 32MB SDRAM
- 512K Pipelined Burst Cache
- CrystalScan®700 .28 Screen Pitch 17" Monitor (15.9" viewable)
- 2MB 3-D 64-Bit PCI Graphics
- 2GB 11ms Ultra ATA Hard Drive
- 12X min/24X max CD-ROM & 3.5" Diskette Drives
- GP-Series Desktop Case
- 104+ Keyboard & MS IntelliMouse
- MS Windows 95 & MS Office 97, Small Business Edition plus Encarta 97
- Gateway Gold Service & Support for GP-Series PCs

$1749 Business Lease* $64/mo.

GP6-233

- Intel 233MHz **Pentium® II** Processor with 512K Cache
- 64MB SDRAM
- CrystalScan700 .28 Screen Pitch 17" Monitor (15.9" viewable)
- **nVidia™ 4MB 3-D AGP Graphics**
- 4GB 11ms Ultra ATA Hard Drive
- 12X min/24X max CD-ROM & 3.5" Diskette Drives
- GP-Series Mid-Tower Case
- 104+ Keyboard & MS IntelliMouse
- MS Windows 95 & MS Office 97, Small Business Edition plus Encarta 97
- Gateway Gold Service & Support for GP-Series PCs

$2399 Business Lease* $88/mo.

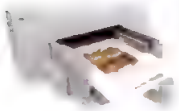
GP6-266 BEST BUY

- Intel 266MHz **Pentium II** Processor with 512K Cache
- 64MB SDRAM
- **EV900 .26 Screen Pitch 19" Monitor** (18" viewable)
- **nVidia 4MB 3-D AGP Graphics**
- 8.4GB 8.5ms Ultra ATA Hard Drive
- 12X min/24X max CD-ROM & 3.5" Diskette Drives
- GP-Series Mid-Tower Case
- 104+ Keyboard & MS IntelliMouse
- MS Windows 95 & MS Office 97, Small Business Edition plus Encarta 97
- Gateway Gold Service & Support for GP-Series PCs

$2899 Business Lease* $107/mo.

Gateway Extras

(Some items only available to new or existing Gateway customers or with the purchase of a system.)



- Hewlett®-Packard DeskJet 694C Color Printer **$269**
- TR4 IDE 4GB Tape Backup Unit with Tape **$199** *(with system purchase)*
- TelePath® Modem *for Windows* with x2™ Technology** **$79**
- Iomega® Internal ZIP™ Drive with Two Discs **$99** *(with system purchase)*

Please call for current pricing on RAM and other upgrades.

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GP-Series PCs For The Small Business

MULTIMEDIA EXPRESSWAY

If you've been battling the traffic of your cramped, outdated digital inner city, hit the black-and-white cow-spotted blinker and head for the multimedia expressway.

Set the Digital Cruise Control

Gateway's classic G-Series multimedia PCs reflect our overall goal: Give customers fresh technology at great prices with excellent service and support. It's the technology you need to let your home productivity and entertainment stretch out and run.

Roll down the windows and feel the rush of sound blasted out by the amazing Boston Acoustics MicroMedia speakers. Check the 18-inch viewable of our EV900 19-inch monitor's windshield and enjoy the scenery unleashed by nVidia's AGP graphics accelerator. By transferring some graphics memory needs to the system's RAM, AGP pops your video performance into overdrive.

Buckle Up for DVD

The future graphics superhighway is marked Digital Versatile Disc (DVD) on the PC development roadmap. If your current CD-ROM-based graphics deliver sports car performance, DVD will seem more like something you'd find on an Indianapolis track on Memorial Day weekend. Each disc holds up to 4.7GB of data, room enough for 133 minutes of video that makes its analog tape ancestors seem like misfiring stationwagons.

Born to Run and Priced to Move

Looking for something with a smaller price than the high-end G-Series rocket ships? How about the G5-166 system? A PC up to Gateway standards featuring MMX™ Technology, quality monitor and a color printer, all for just $1,499. A great on ramp for people new to the computing world, students or for use as a second system. And at this price, you can even wrap one up for someone on your holiday list.

Call Gateway today and get on the computer infobahn where the values are huge and the center line is always cow spotted.

Gateway G6-300XL Multimedia PC with Boston Acoustics Speakers

Gateway G-Series Multimedia PCs for the Home

G6-233 BEST BUY

- Intel 233MHz **Pentium® II** Processor with 512K Cache
- 32MB SDRAM
- CrystalScan700 .28 Screen Pitch 17" Monitor (15.9" viewable)
- **nVidia™ 4MB 3-D AGP Graphics**
- 4GB 11ms Ultra ATA Hard Drive
- 12X min/24X max CD-ROM & 3.5" Diskette Drives
- Ensoniq Wavetable Audio
- **Boston Acoustics® MicroMedia™ 3-Piece Speaker System**
- TelePath Modem *for Windows*, with x2 Technology**
- G-Series Mid-Tower Case
- MultiFunction Keyboard & MS IntelliMouse
- MS Windows 95
- Home Software Titles
- Gateway Gold Service & Support for G-Series PCs

$2399 As low as* $84/mo.

G6-300XL

- Intel 300MHz **Pentium II** Processor with 512K Cache
- 64MB SDRAM
- **EV900 .26 Screen Pitch 19" Monitor** (18" viewable)
- **nVidia™ 4MB 3-D AGP Graphics**
- TV/FM Tuner Card
- 8.4GB 8.5ms Ultra ATA Hard Drive
- **DVD-ROM Drive & DVD Decoder Card**
- 3.5" Diskette Drive
- Ensoniq Wavetable Audio
- **Boston Acoustics® MicroMedia™ 3-Piece Speaker System**
- TelePath Modem *for Windows* with x2 Technology**
- G-Series Tower Case
- MultiFunction Keyboard & MS IntelliMouse
- MS Windows 95
- Home Software Titles
- Gateway Gold Service & Support for G-Series PCs

$3799 As low as* $132/mo.

Gateway Extras

(Some items only available to new or existing Gateway customers or with the purchase of a system.)

- Epson® Stylus® COLOR 400 Ink Jet Printer **$199**
- MS SideWinder™ 3D Pro Joystick **$59**
- Education Software Bundle Grades K-3 or Grades 4-8 **$99** (each)

Please call for current pricing on RAM and other upgrades.

MMX™ intel inside pentium® II processor

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G-Series Multimedia PCs For The Home

SKYSCRAPING BEST BUYS

Get More For Your Money With GATEWAY™ PCs!

Gateway G-Series Multimedia *PC*

G6-233 BEST BUY

- Intel® 233MHz **Pentium® II** Processor with 512K Cache
- 32MB SDRAM
- CrystalScan®700 .28 Screen Pitch 17" Monitor (15.9" viewable)
- **nVidia™ 4MB 3-D AGP Graphics**
- 4GB 11ms Ultra ATA Hard Drive
- 12X min/24X max CD-ROM & 3.5" Diskette Drives
- Ensoniq® Wavetable Audio
- **Boston Acoustics® MicroMedia™ 3-Piece Speaker System**
- TelePath® Modem *for Windows*, with x2™ Technology**
- G-Series Mid-Tower Case
- MultiFunction Keyboard & Microsoft® IntelliMouse™
- MS® Windows® 95
- Home Software Titles
- Gateway Gold™ Service & Support for G-Series PCs

$2399 As low as* $84/mo.

Gateway GP-Series Professional *PC*

GP6-266 BEST BUY

- Intel 266MHz **Pentium II** Processor with 512K Cache
- 64MB SDRAM
- **EV900 .26 Screen Pitch 19" Monitor** (18" viewable)
- **nVidia 4MB 3-D AGP Graphics**
- 8.4GB 8.5ms Ultra ATA Hard Drive
- 12X min/24X max CD-ROM & 3.5" Diskette Drives
- GP-Series Mid-Tower Case
- 104+ Keyboard & MS IntelliMouse
- MS Windows 95 & MS Office 97, Small Business Edition plus Encarta® 97
- Gateway Gold Service & Support for GP-Series PCs

$2899 Business Lease* $107/mo.

Please call for other configurations. We custom build each GATEWAY 2000® system to your specifications.

Gateway Destination™ Big Screen *PC/TV*

D5-200 BEST BUY

- Intel 200MHz Pentium® Processor with MMX™ Technology
- 32MB SDRAM
- 512K Pipelined Burst Cache
- Destination 31" SVGA Monitor
- 2MB Graphics Accelerator with Cable-Ready TV Tuner
- 4GB 11ms Ultra ATA Hard Drive
- **DVD-ROM Drive & DVD Decoder Card**
- 3.5" Diskette Drive
- Ensoniq Wavetable Audio
- **Boston Acoustics MicroMedia 3-Piece Speaker System**
- TelePath Modem *for Windows* with x2 Technology
- 7-Bay Charcoal-Colored PC Case
- Cordless Keyboard w/ Integrated EZ Pad® Pointing Device
- Cordless Field Mouse® Remote
- MS Windows 95
- Home Software Titles
- Gateway Gold Service & Support• for Big Screen PC/TVs

$2999 As low as* $104/mo.

Gateway Solo™ Portable *PC*

9100XL BEST BUY

- **13.3" XGA TFT Color Display**
- Intel 233MHz Pentium Processor with MMX Technology
- 64MB SDRAM (expandable to 192MB)
- 256K Pipelined Burst Cache
- **4MB EDO Video RAM (1280 x 1024 external)**
- **Removable Combo 6X min/11X max CD-ROM & 3.5" Diskette Drive**
- USB Ports & Zoomed Video
- NTSC/PAL Video Input & Output
- 5GB Hard Drive
- Premium 16-Bit Wavetable Sound & Stereo Speakers
- PC Card Modem with x2 Technology**
- Two 12-Cell Lithium Ion Batteries & AC Pack
- External Battery Charger
- Full 88-Key MS Windows 95 Keyboard
- EZ Pad Pointing Device
- Executive Carrying Case
- Gateway Solo Mini Docking Station
- MS Windows 95
- MS Office 97, Small Business Edition plus Encarta 97
- Gateway Gold Service & Support for Portable PCs

$5699 As low as* $198/mo.

GSA Schedule # GS-35F-4565G

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Toll Free from Puerto Rico
800-846-3613

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DIGITAL CAMERAS

High-Resolution Snapshots

In the past year, the digital camera has been transformed into an affordable peripheral. Top-notch entries are now available for little more than what you would pay for a good standard-film point-and-shoot camera.

DIGITAL DAZZLE: *The new Olympus D-320L digital camera.*

Olympus America (800-347-4027, *www.olympus.com*), the longtime single-lens-reflex and point-and-shoot camera maker, now has two new offerings in its line of digital cameras: the **Olympus D-220L** ($500 street) and the **Olympus D-320L** ($700 street). Both cameras are loaded with features, including +/- one-f-stop exposure control, a four-mode flash with red-eye reduction and lowlight or backlight modes, and an all-glass f2.8 lens. Also, they each have direct connectors to the Olympus P-300 photo printer and a TV/VCR port. Both cameras come with Adobe PhotoDeluxe 2.0, InMedia Slides&Sound, and Panorama Stitching Software.

Each camera features Toshiba's brand new, compact SmartMedia card; this storage device can hold up to 2MB of data. The removable card can be inserted into PCs and peripherals in a number of ways to help transfer data. Since the Olympus D-220L has a resolution of 640-by-480 pixels, it can store up to 80 images on its SmartMedia card. The Olympus D-220L, with a resolution of 1,280-by-768 pixels, can store up to 30 images on the card.

Not to be outdone, Eastman Kodak (800-235-6325, *www.kodak.com*) offers the **Digital Science DC210 Zoom Camera** ($900 street). The successor to the Digital Science DC120 Zoom Camera, the DC210 offers "megapixel" resolution, which means it can generate 1,152-by-864 pixel images—a format that is especially ideal for graphic-design professionals.

The DC210 comes with a 2X zoom lens with close-up mode, an infrared port for PC communication, and a video-out jack for TV or VCR viewing. There's also 4MB of storage thanks to Kodak's Digital Science Picture Card, which allows you to store up to 60 pictures.

Also included is an ample software bundle that features Kodak's new Picture Easy 2.0 (for making basic corrections and printing images), Adobe PhotoDeluxe 2.0, and Adobe PageMill 2.0.—*JL*

PRINTER SOFTWARE

Fun with the Family Inkjet

If you want to turn your ink jet printer into an arts-and-crafts playground, take a look at the popular line of printing kits from PrintPaks (800-774-6860, *www.printpaks.com*). A wide range of offerings, including the $19.95 **Calendar Kit** and the recent $29.95 **Lost World Jurassic Park** multimedia kit, allows kids of all ages to make paper dolls, jewelry, books, holiday ornaments, calendars, and iron-ons. Each kit comes with accessories like spiral binding or actual t-shirts; you can refill the supplies directly from the company or at many retail outlets.—*JL*

NETWORK PRINTERS

New Lasers for Your LAN

Although color printing grabs all the headlines, most of us still churn out our hard copy on monochrome network laser printers. New offerings from Xerox Corp. (800-349-3769, *xerox.networkprinters.com*) and Apple Computer (800-776-2333, *www.apple.com*) highlight many of the latest improvements in network printing, such as sorting and stapling options and greater speed.

Xerox is going head-to-head with industry giant HP with its 24-ppm (page per minute) **DocuPrint N24** ($2,450 street) and 32-ppm **DocuPrint N32** ($2,900 street) network laser printers. Brand new from the ground up, these printers offer a host of finishing features, including staplers, duplexers, and high-capacity input trays. Also, they each contain a "RIP-once, print-many" architecture that makes printing multiple originals even more convenient than using the office copier.

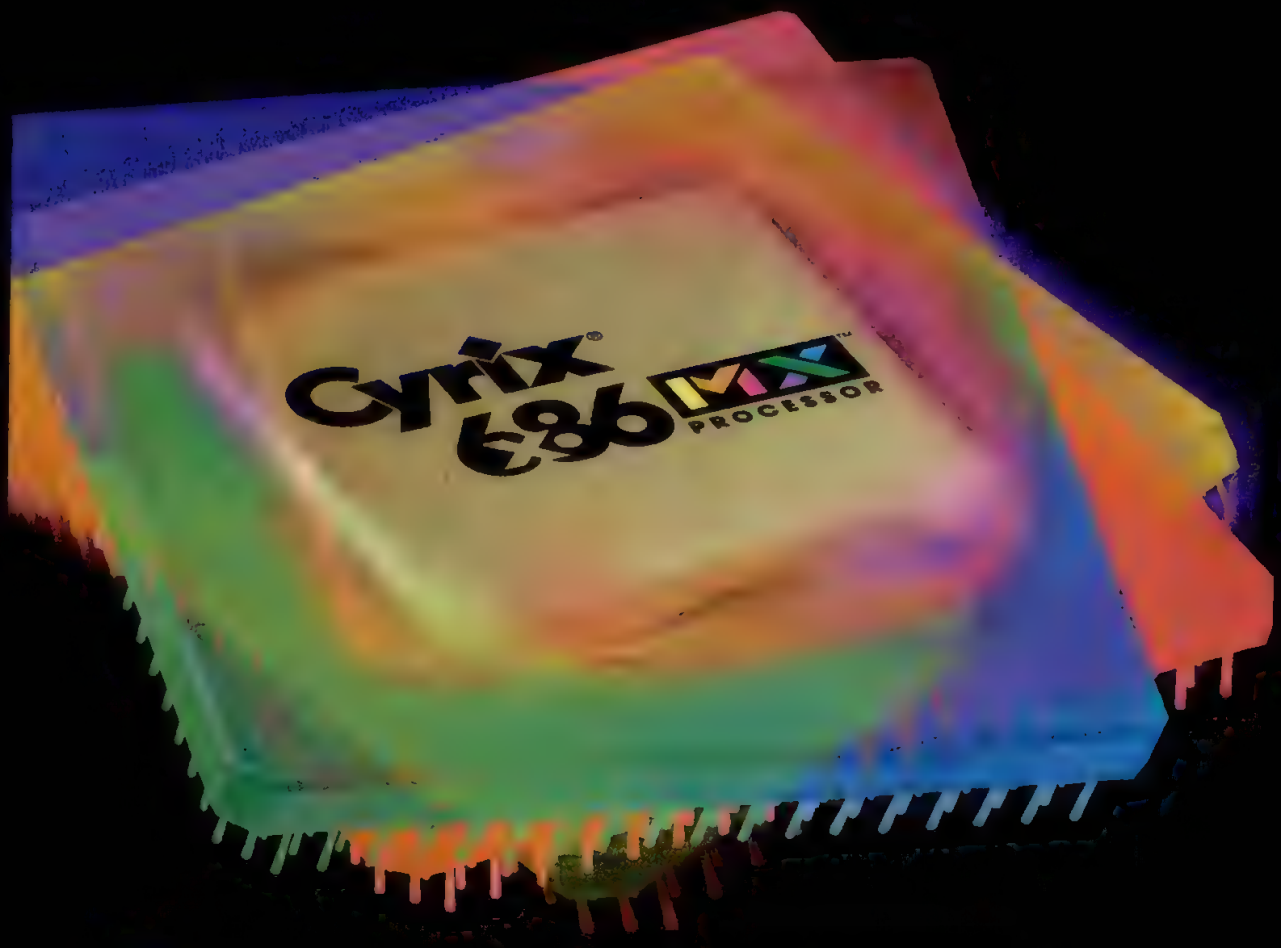
NETWORK MUSCLE: *Network printers from Xerox (left) and Apple (right).*

Unlike other printers in this class, each of these units offers Ethernet connectivity, 12MB RAM (which is expandable to 128MB), and Adobe PostScript support. Also, each has two 500-sheet input trays and a 500-sheet output tray that can deliver jobs collated, with each copy slightly offset from the last (this makes it easier to find the spot where one copy ends and the next one begins). Print resolution from the new Fuji Xerox engine is 600 dpi (dots per inch). Xerox has added its patented Quad Dot halftoning technology in order to further boost print quality.

The duplexer, mailbox, and 200-sheet finisher/stapler can be installed by the user. Xerox claims that duplex imaging can be achieved at near engine speeds. The vendor also includes its new PrinterMap enterprise-management software utility, which lets network administrators configure any SNMP-compliant printers on the network.

Apple's **LaserWriter 8500** ($2,000 street) is a full-featured, 20-ppm laser printer for the business, desktop publishing, and education markets. The LaserWriter is one of the first printers on the market to support Adobe Postscript 3. The paper-feed system can support up to 13- by 20-inch paper, and the printer's maximum resolution is 600 dpi.

Apple includes a 60-MHz RISC processor (by AMD) with the unit along with a network adapter that is compatible with TCP/IP, AppleTalk, EtherTalk, and Novell NetWare. The printer supports Apple's own MacOS as well as Microsoft Windows 3.1, Windows 95, Windows NT, and Unix. It also comes with a business-oriented software bundle featuring the Now Up-to-Date contact manager, Nova's Art Explosion Sampler, and Adobe Type Manager.—*Joshua Levy*



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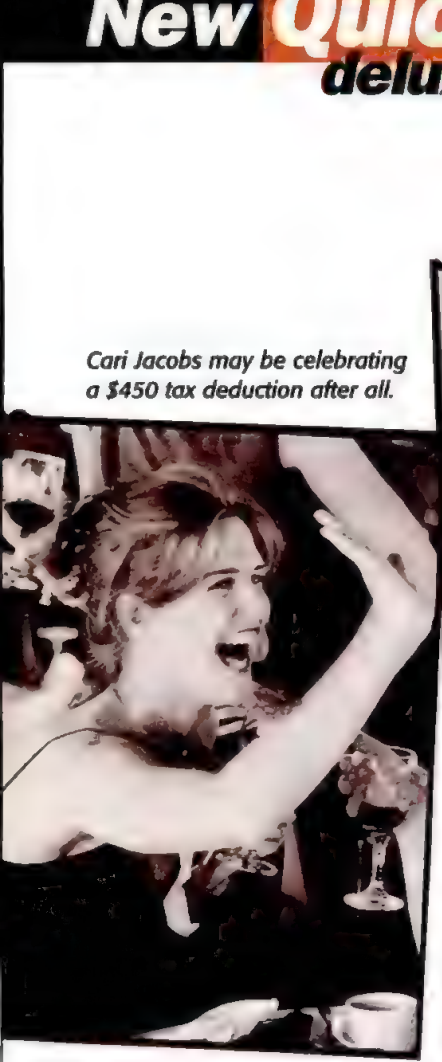

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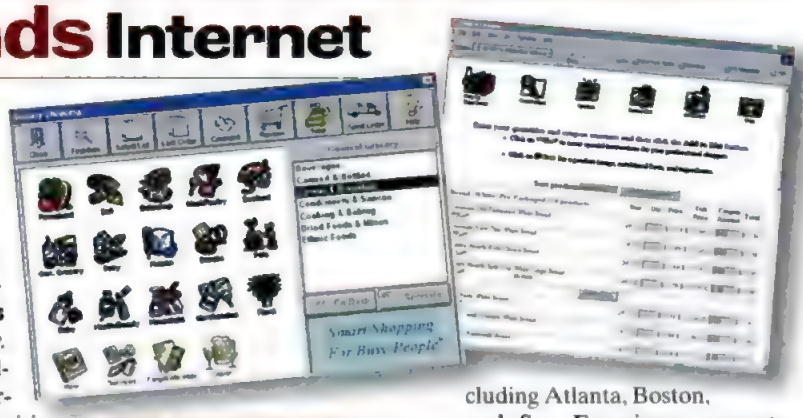


HOME GROCERY CHANNEL: *Shop by modem with Peapod (left) and Shoppers Express (right).*

Selling merchandise over the Net seems an obvious fit for some items, such as modems or software. But groceries? For those too busy or physically unable to go to the store, three new services allow online shopping for everything from orange juice and a loaf of bread to toilet paper—all with just a credit card and Internet access.

We take a look at **NetGrocer** in this issue's feature story, "Let's Go Shopping." NetGrocer sells nonperishable items such as canned goods and can deliver to any location that's serviced by FedEx. The two services that are described here take a more local approach.

After a decade of experience in grocery delivery, **Shoppers Express** (800-284-7467, *www.shopx.com*) has expanded its reach to the Internet. Operating in eight cities—including Los Angeles, Dallas, and Columbus, Ohio—Shoppers Express lets you search for items, pick products by department, and see what's on sale. Exact brand names appear in a list, and a special feature lets you deduct coupon amounts from the cost. The shopping and delivery fee varies by location; for residences in Los Angeles, the cost is $9.95. For businesses, the fee is 10 percent of the order amount, with a minimum of $9.95. There are no membership fees or additional charges.

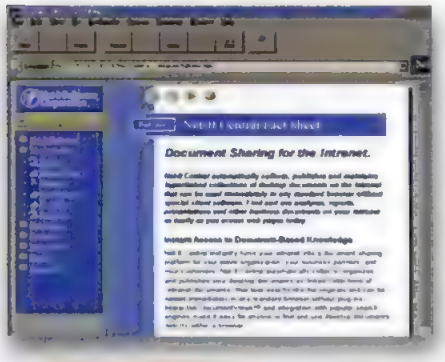
Shoppers can access **Peapod** (800-573-2763, *www.peapod.com*) using proprietary software and a network or dial-up modem connection. The service—currently available in eight metropolitan areas, including Atlanta, Boston, and San Francisco—presents icons for typical supermarket aisles, and you can drill down from there or search for specific items. You can also choose to have the food delivered or pick it up. Shopping with delivery costs $4.95 plus 5 percent of your order total; if you pick up your merchandise, the service costs $1.95 plus 5 percent of your order. Peapod requires a monthly $4.95 membership fee.—*Michael W. Muchmore*

ENTERPRISE DOCUMENT SHARING

Access for Everyone

The push for thin clients and network computing hasn't made traditional client/server applications obsolete, but it has encouraged companies to consider alternative database- and document-sharing solutions. These new products let businesses publish documents to intranets or the Internet in a searchable, sharable form with little client-side investment.

ShowBase Extra 2.0, from ShowBase Media (819-685-2273, *www.showbase.com*), lets a company convert a database into HTML, index the content, and publish it to a Web server. Users can view the content via a search interface that they can modify using drag-and-drop commands, HTML, Java, or JavaScript. The program supports more than 40 database packages, including DB2, Oracle, and Sybase, as well as supporting 15 server platforms via CGI scripts. ShowBase's pricing varies with CGI platform, starting at $1,499 for publishing five databases.



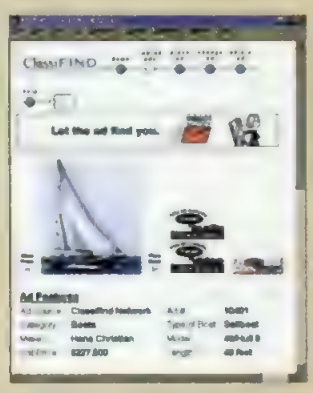
DATABASE BROWSING: *A demo of Net-It Central on Net-It Software's Web site.*

Net-It Software Corp. (415-551-0600, *www.net-it.com*), capitalizing on its document-container technology jDoc, offers **Net-It Central**—a server-side solution for publishing documents in their original formats to an intranet. Users can view the data using standard browsers without plug-ins, and jDoc replicates most desktop documents (including Excel spreadsheets and Lotus database reports) without conversion to HTML. Companies can customize the organization of files and integrate support for search engines, including those from Microsoft and Netscape. The Standard Edition costs $4,995; the Professional Edition, whose open API allows for further customization, is $6,995.

You can re-create your paper office online with Infodata Systems' **Virtual File Cabinet** (800-336-4939, *www.infodata.com*). VFC lets users access, organize, and share documents regardless of format and location on the network. Documents reside in a VFC repository, and the software creates links to them on each desktop.—*Regina Kwon*

MULTIMEDIA CLASSIFIEDS

Look Before You Buy



Are you in the market for a used car? Maybe you're looking to sell your old catamaran. Don't waste time with dull newspaper ads. Instead, point your browser to **ClassiFind**, from the ClassiFind Network (691-874-3692, *www.classifind.com*)—the first multimedia classifieds Web site.

For a mere $4.95 a month, you can post a 200-word description of your product or service. What's more, you can add pictures, sound, and even streaming video. If you're a buyer you can use ClassiFind to locate everything from old leather-bound books to vacation property, and you can take a look at an item before you put in a bid. Looking for a new job? ClassiFind can help you find that too, with listings for all 50 states.

If you don't see what you're looking for right away, you can use Direct-Notify, an intelligent search agent that notifies you via e-mail when new ads match your search criteria.—*William Kravitz*

PRINT SERVERS

Server It Right Up

Ever since networking companies realized that small businesses had the same computing needs as their larger brethren, the market has been flooded with products that accommodate those needs. Hewlett-Packard Co. (800-752-0900, *www.hp.com*) and Linksys (800-546-5797, *www.linksys.com*) are offering small-scale print servers with large-scale features for less than $400.

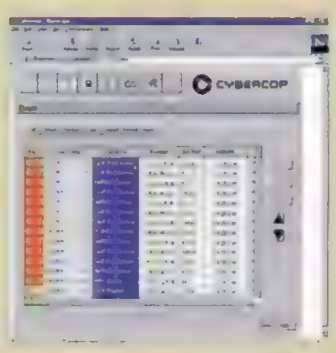
SMALL AND MIGHTY: *The mini HP JetDirect 150X.*

For those with small Ethernet networks, HP has recently announced the availability of its $199 **HP JetDirect 150X** print server. This small box comes with a single RJ-45 port that can connect to any NetWare 3.*x* and 4.*x* or Windows NT 3.*x* and 4.0 networks. On the client side, the JetDirect 150X supports Windows 3.*x*, Windows 95, Macintosh, and DOS. It also shares some of the advanced management features of its larger siblings. For example, the printer lets users know when it's out of ink or paper. The printer can also send a message when its memory is full or the ink pens need realignment.

Aimed at beefier networks, the **EtherFast 3-Port 10/100 PrintServer,** from Linksys, has a single auto-sensing RJ-45 port. It also features three bidirectional ports that can be connected to most printers and plotters. Like the JetDirect 150X, the EtherFast can be configured for two-way communications between the print server and the PCs. Currently, the EtherFast supports Microsoft Windows 95, Windows for Workgroups, Windows NT, and NetWare 2.2, 3.*x*, or 4.*x*.—*Robert Daly*

NETWORK SECURITY

The LAN Beat



NETWORK RAP SHEET: *CyberCop records all suspicious network traffic.*

When it comes to protecting your data, there's no such thing as too much security. A firewall is a good start (it's the virtual lock on the front door, so to speak), but it can't stop those who want to break-in through the windows of your network. Network General (800-764-3337, *www.ngc.com*), of Sniffer fame, has a simple answer: Buy an alarm system that lets you know if anyone even touches the window (see "Network Burglar Alarms," June 24, 1997).

Network General's soon-to-be-released turnkey hardware- and software-based **CyberCop** (pricing was unavailable at press time) watches key segments of your networks and unobtrusively scans the data flow for suspicious activity. If CyberCop matches suspicious activity to a database of known hacker behavior, it will send an alert to the administrator and log the activity to a permanent record for later trend analysis and evidence of network tampering.

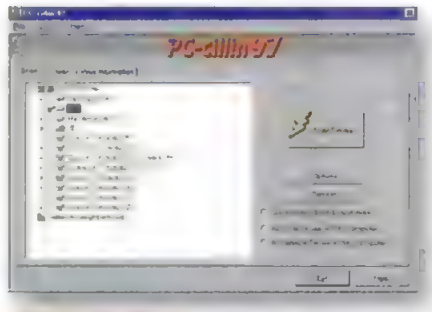
In order to protect your network from external attacks, you must install an individual CyberCop unit at every entry point to the network (routers, modem racks, etc.). And since a large percentage of network attacks are internal in nature, CyberCop can be installed on an internal segment as well. But you can manage all of the CyberCops from a single centralized console.—*RD*

NETWORK ANTIVIRUS

Inoculating Your Network

Unlike the common cold, computer viruses can be cured. Three vendors—IBM (800-742-2493, *www.av.ibm.com*), Intel Corp. (800-538-3373, *www.intel.com*), and TouchStone Software Corp. (800-531-0450, *www.checkit.com*)—have recently released their own network vaccines.

The latest version of **IBM AntiVirus 3.0 Enterprise Edition for Networks** is aimed at customers with global networks. It provides an automatic translation of its management console to match the local language (your choice of English, French, German, Italian, Japanese, Portuguese, and Spanish). Starting at $620 for 25 user licenses, the product includes a server-to-server configuration feature that allows a single NetWare server to distribute the software to all other NetWare servers on the network. It also offers remote configuration, which lets the administrator distribute custom configurations to any NetWare server on the network, and remote operation, which lets the entire application be managed from a single console. IBM AntiVirus runs on NetWare 3.*x* or 4.*x*, Microsoft Windows 3.*x*, Windows 95, Windows NT Server 3.51 or 4.0, and OS/2 Warp Networks.



SHOT IN THE ARM: *PC-cillin scans your network for a variety of computer viruses.*

Intel Corp. has added several new features to its **LANDesk Virus Protect 5.0** ($1,495 for a single server license). The product has a new centralized management console that simplifies installation, updates, and routine maintenance. Once the administrator configures the initial installation, the product automatically distributes virus updates throughout the network. LANDesk features three layers of antivirus protection: real-time background scanning of incoming data, integrity shields that prevent file modification or deletions, and integrity verification scans to limit the spread of viruses. LANDesk supports NetWare 3.*x* or 4.*x*, Windows 3.*x*, Windows 95, and Windows NT Server 3.51; a DOS version is forthcoming.

Developed in conjunction with Trend Micro Inc., TouchStone Software Corp.'s **PC-cillin Corporate Edition 2.2** ($995 for 50 users) provides administrators with an easily distributed and updatable antivirus solution for their networks. After installing the product on a network server (running either NetWare 3.*x* or 4.*x* or Windows NT 3.51 or 4.0), the server will automatically install the appropriate software and distribute virus updates to DOS, Windows 3.*x*, Windows 95, and Windows NT 3.51 or 4.0 clients.

PC-cillin's central administration utility allows network administrators to set the level of virus protection, create security policy, and schedule virus scans for each of their clients. Even uuencoded and MIME mail files can be scanned for infections.—*RD*

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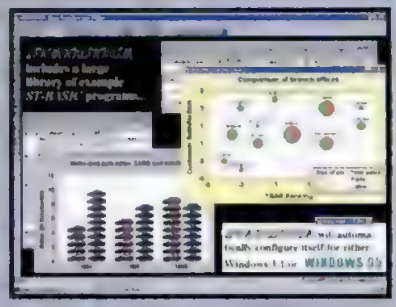

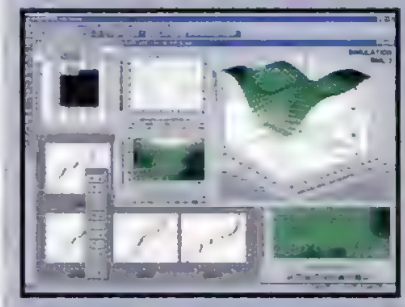

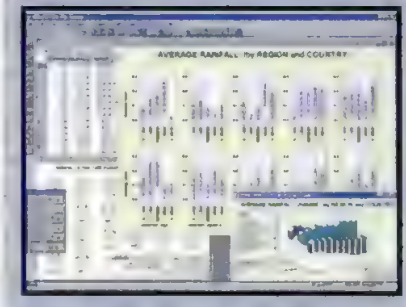

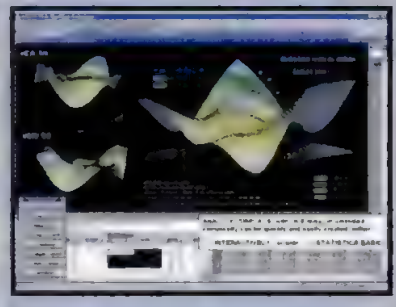

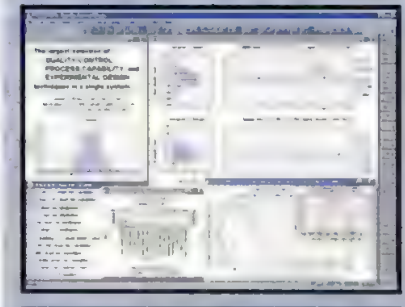

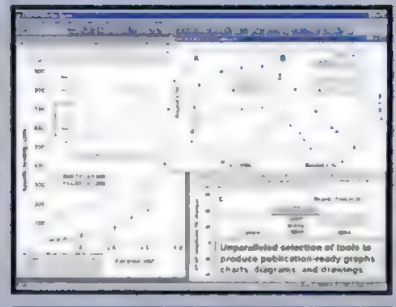

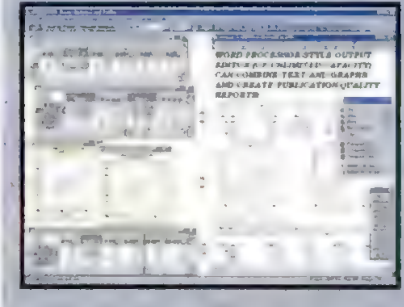

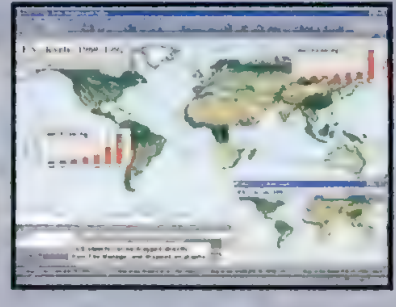

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First Looks

LCD Projectors Take The Next Step

The new generation of LCD projectors are not only smaller and lighter but brighter too, offering better quality, XGA-resolution images.

By Alfred Poor

As processing power becomes more affordable, PC users are raising their expectations about display resolutions. On the desktop, 1,024-by-768 pixels (often referred to as XGA) has become the norm, displacing the 800-by-600 Super-VGA resolution that was the standard not so long ago. Although the LCD projector segment is just a tiny fraction of the computer display market, it has followed this higher-resolution trend. Now, top-of-the-line LCD projectors with XGA-level-resolution display engines are available to buyers.

At the same time, these projectors are getting lighter and brighter. Three of the five units in this group each weigh less than 15 pounds. And though not one lives up to its rated brightness, each is rated at 350 to 500 ANSI lumens, which is sufficient to view images even under normal room-lighting conditions.

IN THIS REVIEW

For this roundup, we looked at five new XGA-resolution projectors: the ASK LCD Impression A6, the In Focus LitePro 730, the MediaShow 1024, the NEC MultiSync MT1000, and the Proxima Desktop Projector 9200. (We previously reviewed the Epson PowerLite 7000 in our October 21, 1997, issue.) All units cost between $11,000 and $13,000 (list prices).

You can also expect to see XGA-resolution projectors from other manufacturers shortly. No less than seven companies—Epson, Mitsubishi, Sanyo, Philips, Toshiba, Sharp, and Polaroid—have announced new models that were not available in time for this roundup.

To evaluate these projectors, we put them through the same tests that we ran in our August roundup of portable SVGA projectors. To create a series of test images, we used DisplayMate for Windows, from Sonera Technologies (908-747-6886, *www.displaymate.com*). We followed ANSI (American National Standards Institute) protocols to determine brightness and contrast measurements. And we used a Tektronix J17 readout base with a J1811 measurement head that's designed to measure light levels from red-green-blue sources, such as LCD projectors.

FEATURES ABOUND

Our tests revealed a number of similar features across the

INSIDE

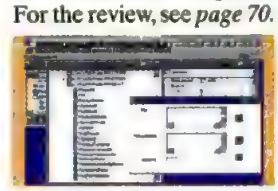
MARK IT UP:
MicroTouch's Ibid whiteboards are affordable and come in many sizes.

For the story, see *page 52.*

GET TO WORK:
Microsoft's Project 98 is a valuable and usable project management tool. See *page 56* for the review.

POSTER PRINTING:
HP's DesignJet 2500CP and Roland Digital's CammJet CJ70 are large and in charge. See *page 62.*

COOL BEANS:
With Visual Café for Java 2.0, Symantec lets you do Java database development. For the review, see *page 70.*



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VideoBrush Whiteboard and Panorama....78

PHOTOGRAPHY BY THOM O'CONNOR

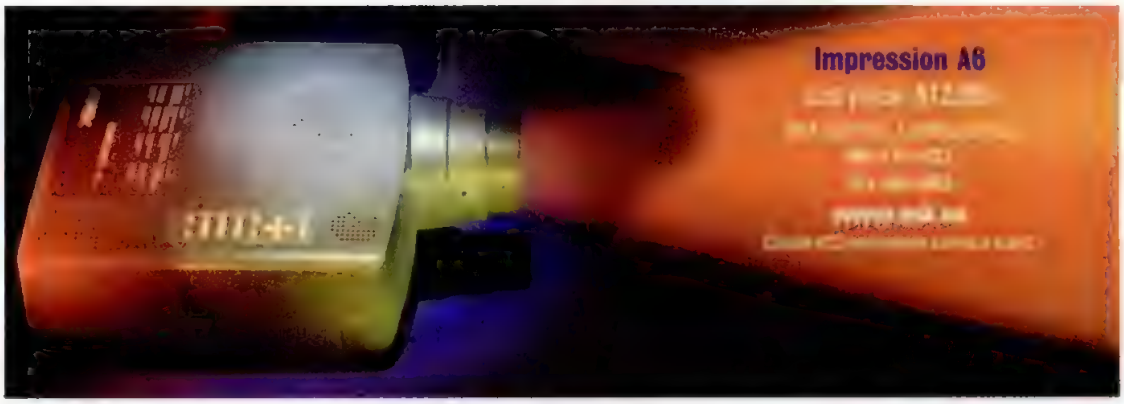
field. For example, all of the units are designed for use with front- or rear-projection screens, and all can be mounted upside down on the ceiling. All use metal halide lamps, which gradually become dimmer with use and are rated in terms of how many hours it takes them to reach half their original brightness. All can compress 1,280-by-1,024 signals, although you will obtain a better-quality image if you don't go above the 1,024-by-768 panel resolution.

Each projector had flaws in its LCD panel. Four of the projectors each use three polysilicon active-matrix LCD panels (the MediaShow 1024 uses a single 10.4-inch active-matrix panel), which means that there are a more than 2.3 million cells (1,024 x 768 x 3 = 2,359,296). Given current manufacturing techniques and yields, you can reasonably expect there to be one or more flaws on each panel.

All of the projectors had one or more stuck pixels (where a cell is always illuminated), even on all-black images. These flaws can be annoying, but guaranteeing three perfect panels every time would push the cost per projector into the stratosphere.

We also found important and sometimes surprising differences among the units. First of all, the biggest were not necessarily the brightest. Also, each projector has its own added (or missing) feature that may make a major difference in your application.

So if you need to present your case to a large audience and want to be able to show every detail with high-resolution delivery, one of these new LCDs is just what you'll need to project the big picture.



ASK LCD

Impression A6

The ASK LCD Impression A6 holds a number of superlative positions in this comparison group. With a list price of $12,995, it is the most expensive projector in this roundup. Tipping the scales at just 11 pounds, it is also the lightest of the group. The Impression offers a combination of unique features, which may make it perfect or impossible for your particular application.

ASK LCD is the only vendor in this group to include a soft-sided carrying case as a standard feature. The Impression A6 is also one of only two projectors offering manual zoom and focus. This is not likely to pose a problem for most portable applications, but it could be inconvenient for ceiling or rear-projection installations. Unlike other projectors with separate data and video signal inputs, the Impression A6 uses a muiltimedia cable with multiple inputs.

The remote control has lighted buttons, which is a big plus if you use it in a dark room. The projector also has a hardware-generated pointer that you can turn on and off or control with the remote. A variable-speed cooling fan responds to the temperature inside the projector, which minimizes fan noise.

Setup and installation are easy, and the projector includes a good complement of cables to simplify connections. The monitor pass-through uses a connector on the projector itself—which may not be convenient for some installations—but it works even when the projector is turned off. Brightness and contrast settings are easily accessible without you having to go through layers of on-screen menus.

The Impression A6 showed well on our tests. It garnered the best White/Black Contrast ratio of the five projectors, which contributed to its sharp images. The Brightness Variance score was also very good, confirming the observation that there were no obvious hot spots or dim regions in projected images. The measured Brightness Variance score of 341 lumens is somewhat below the projector's 450 ANSI lumen rating, but it is still sufficient to project color images under normal room-lighting conditions.

Our evaluation unit featured

PERFORMANCE TESTS

XGA LCD Projectors

We determined the Average Brightness measurement following the ANSI test procedures and report the result in lumens (a lumen is a measure of the amount of light reaching the screen per square meter).

Brightness Variance is a measure of the image illumination uniformity. A totally even lighting system would have a score of 1.0; lamp design and variances in an individual projectors' optics, however, make the lighting uneven.

Bold type denotes first place	Average Brightness ANSI lumens	Brightness Variance Score	White/Black Contrast Ratio
ASK Impression A6 XC	341	1.2	74.8
In Focus LitePro 730	190	1.1	62.5
NEC MultiSync MT1000	369	1.3	58.1
Proxima 9200	450	1.2	67.4
Sayett MediaShow 1024	211	1.7	31.5
	BETTER ►	◄ BETTER	BETTER ►

only one noticeable pixel defect. The company's policy calls for replacement if the projector has 6 or more defects on one of the three LCD panels or if it has a total of 11 or more defects in all. The entire unit is backed up by a one-year warranty, including overnight replacement.

The metal halide lamp is rated for 2,500 hours (the longest rating of any lamp in this group), but it is also one of the most expensive at $499 (list price). This works out to about 20 cents per hour across its rated life, which matches the lowest cost per hour for the entire group.

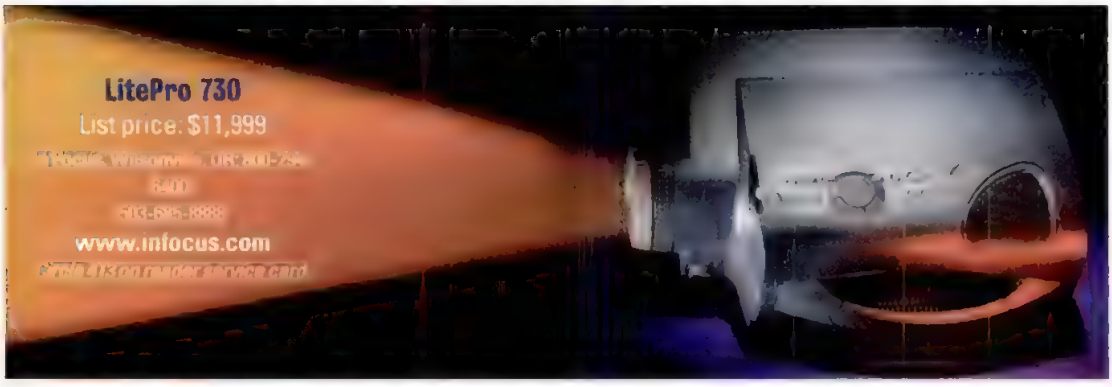
This Impression A6's biggest strengths are its light weight, bright image, and strong warranty coverage. On the downside, its lack of powered zoom or focus and price ($1,000 above the competition) detract from its appeal. It's a strong competitor, however, and may well be the best choice for some users.

In Focus

LitePro 730

The $11,999 (list) LitePro 730, from industry-leader In Focus, has a number of attractive features, but its disappointingly dim image lessens its appeal.

The projector weighs just 12 pounds, making it well-suited for portable applications. The stylish—but optional—case has an integral handle along one side, making it easy to move the projector around.



Editors' Choice

• Desktop Projector 9200

With list prices upwards of $10,000, XGA LCD projectors can be considered major investments. Even though all five of these units share many of the same features, one stands out above the rest: The Desktop Projector 9200 ($11,999 list). We award this projector our Editors' Choice.

The Desktop Projector 9200 is compact, weighs just 14 pounds, and produces a bright, sharp picture. This projector was about 25 percent brighter than its nearest competitor, an advantage that really shows when you leave the room lights on during a presentation. With a strong range of features and a three-day replacement service under the warranty, the Desktop Projector 9200 is a great choice for an XGA LCD projector.

Installation and setup are relatively easy. One of the key features of this unit is the In Focus CableWizard, which provides a single connection point for PC graphics, mouse, sound, and monitor loop-through connections. A single cable ending in a high-density connector then carries all these signals to the projector. The projector has manual zoom and focus, which are fine for most portable applications but could be inconvenient in some ceiling or rear-projection installations.

The LitePro 730 comes with a simple remote control that is limited to two buttons and a puck. (A full-featured remote is available as an option.) The on-screen menu is readily accessible using the buttons on the projector's control panel. The brightness setting can be controlled directly, but the contrast control requires the use of the menu system.

Out of all the projectors in this roundup, the LitePro 730 comes with one of the most thorough and useful manuals, and the manual is even supplemented by a user's guide on CD. In Focus also comes bundled with its own presentation software—In Focus Presents.

On our performance tests, the unit's Average Brightness score was only 190 lumens, far short of the projector's 450 ANSI lumen rating. This should be adequate for black-and-white images under normal room-lighting conditions, but colors may look a bit washed out unless the lights are dimmed. The system's White/Black Contrast score was good, and its near-perfect Brightness Variance score of 1.1 was the best of the group.

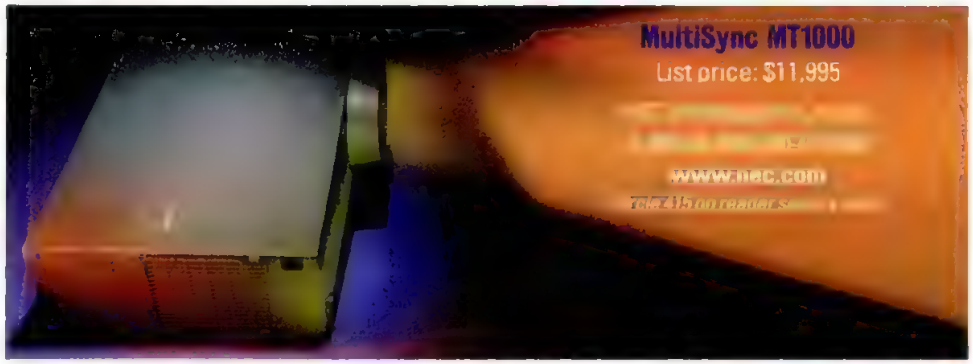
The image focus was slightly off; when the right portion of the image was in sharp focus, the left side was a little blurred. The projector may also be a bit weak in terms of bandwidth for 1,024-by-768 resolution: Fine vertical black-and-white lines tended to go to gray and appear darker than fine horizontal black-and-white lines, though this would only detract from images with a lot of fine detail. The only other negative worth mentioning is that the cooling fan in this projector is a bit louder than the fans in some of the other units.

Our evaluation unit had a pair of bright pixel defects. The company's warranty policy on pixel defects is to replace the projector if five or more pixels are defective. The warranty also covers the projector (excluding the lamp) for a year, with a turn-around of five business days on warranty repairs. The metal halide lamp is rated for 2,000 hours, and the $495 replacement cost makes it the second-most expensive of the group to operate (the cost is 25 cents per hour).

Though it would be much improved by a brighter image, the LitePro 730 is an appealing choice for its ease of operation and light weight.

NEC Technologies

MultiSync MT1000



The MultiSync MT1000, from NEC Technologies, carries a list price of $11,995, which is a similar price to some of the other units in this group. And with a weight of just under 16 pounds, it is slightly heavier than the other projectors in this roundup (with the exception of the MediaShow 1024). In comparison with its competitors, the MultiSync's image is bright and its quality is generally good.

Installation and setup are easy, thanks to the well-marked connectors, power zoom and focus, and convenient on-screen menu system. The remote control has only one lighted button (the menu button), but this is offset by the presence of a built-in laser pointer (the MultiSync is the only projector in the group to include this handy feature).

The projector also takes an unusual approach to providing mouse control of your PC: It comes with an infrared receiver that plugs directly into your PC, providing a wireless pointing solution. A remote control then lets you select the signal source and adjust focus and zoom directly. The remote has a useful magnification feature that lets you enlarge a portion of the image.

On our tests, the MultiSync had the second-highest Average Brightness score at 365 lumens, which is not far off its 450 ANSI lumen rating. The White/Black Contrast score of 58 was a bit low for the group, and the Brightness Variance score of 1.3 reflected our observation that the image was slightly dimmer in the upper-left quadrant.

Our evaluation unit had three small pixel defects; the company's policy is complex and based on the number and location of defects. For example, if the pixel is out in the center of the screen, NEC will replace the unit. For the most part, the images were stable and had strong colors.

The MultiSync's metal halide lamp costs $399 and is rated for 2,000 hours, which works out to about 20 cents per hour. You can choose among several optional carrying cases, ranging in price from $219 to $349. NEC's warranty is for one year (2,000 hours or 6 months on the lamp), and coverage provides your choice of either overnight replacement or—for those who need to retain the same unit—or 72-hour turnaround on repair (NEC pays shipping both ways).

Although it is not the best projector of the bunch, the MultiSync MT1000 is still a strong competitor and worthy of consideration. On the whole, it provides a good-quality display with above-average brightness in a convenient package. It also offers an impressive set of features.

SUMMARY OF FEATURES

XGA LCD Projectors

PC MAGAZINE EDITORS' CHOICE

■ YES ▩ NO □ OPTIONAL

Products listed in alphabetical order	ASK LCD Impression A6 XC	In Focus LitePro 730	NEC MultiSync MT1000	Proxima Desktop Projector 9200	Sayett MediaShow 1024
List price	$12,995	$11,999	$11,995	$11,999	$11,450
Dimensions (HWD, in inches)	5.4 x 9.8 x 11.6	6.0 x 11.7 x 15.3	5.7 x 15.5 x 12.6	5.8 x 10.2 x 15.4	9.8 x 18 x 18.8
Weight (pounds)	11.0	12.0	15.9	14.1	26.0
Carrying case	■	□	□	□	□
LCD type	3-panel polysilicon	3-panel polysilicon	3-panel polysilicon	3-panel polysilicon	1-panel active-matrix
Actual resolution	1,024 x 768	1,024 x 768	1,024 x 768	1,024 x 768	1,024 x 768
Highest interpolated resolution	1,280 x 1,024	1,280 x 1,024	1,280 x 1,024	1,280 x 1,024	1,280 x 1,024
Lamp type/Rated ANSI lumens	Metal halide/450	Metal halide/400	Metal halide/450	Metal halide/500	Metal halide/350
Rated hours/Replacement cost	2,500 / $499	2,000 / $495	2,000 / $399	2,000 / $399	750 / $299
Zoom lens	Manual	Manual	Power	Power	None
Keystone adjustment	■	■	■	■	■
Number of speakers	4	1	2	2	2
Watts per channel	1W	3W	1W	2W	3W
RGB inputs	2	1	2	2	1
Video inputs	None	1	2	2	1
Other inputs	Serial (mouse)	Mouse, audio	4 audio, serial, remote	4 audio, 2 serial	3 audio
Remote	■	■	■	■	■
Remote acts as a PC mouse	■	■	■	■	□
Y-cable or pass-through port for external monitor	■	■	■	■	■
Reverse image (for rear projection)	■	■	■	■	■
Flip image (for ceiling mount)	■	■	■	■	■
Macintosh-compatible	■	■	■	■	■
Warranty length (parts and labor)	1 year	1 year (excluding lamp)	2 years (2,000 hours or 6 months on lamp)	1 year (excluding lamp)	1 year (750 hours on lamp)
Quick-exchange or quick-repair program under warranty	Overnight exchange	5-business-day exchange	Overnight exchange or 72-hour repair	72-hour exchange	3-to-5-business-day repair

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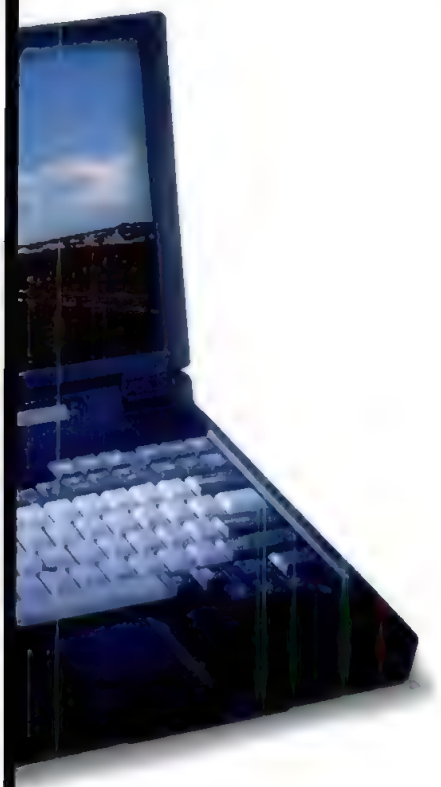

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Intel 200MHz Pentium processor with MMX technology
32MB SDRAM
2.1GB Ultra ATA SMART EIDE hard drive
15" Micron 500Lx, .28dp (13.7" display)

512KB pipeline burst cache, flash BIOS, DMI 2.0
Intel Pro/100 with Wake On LAN Network Adapter
16X EIDE variable speed CD-ROM drive
S3 ViRGE graphics accelerator, 2MB EDO RAM
Microsoft Mouse
Microsoft Windows 95
Intel LANDesk Client Manager
5-year/3-year Micron Power limited warranty

$1,749
Bus. Lease $60/mo.

ClientPro XLU

Intel 266MHz Pentium II processor with MMX technology
32MB EDO RAM
2.1GB SMART EIDE hard drive
17" Micron 500FGx, .28dp (13.7" display)

512KB internal L2 secondary cache, DMI support
3Com PCI 10/100 ethernet NIC
16X EIDE variable speed CD-ROM drive
PCI 64-bit 3D video, MPEG, 4MB EDO RAM
Upgradable wavetable audio with speakers
Microsoft Intellimouse™
Microsoft Windows NT Workstation
Intel LANDesk Client Manager
5-year/3-year Micron Power limited warranty

$2,649
Bus. Lease $90/mo.

***On-site service for NetFRAME LV2000 and MV5000 server is provided by Digital Equipment Corporation and is optional.

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MMX intel inside pentium

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133MHz Intel Pentium processor
16MB EDO RAM (40MB max.)
1.4GB hard drive
16X modular CD-ROM drive
Li-Ion battery
12.1" TFT SVGA, 800x600 display
256KB L2 pipeline burst cache
PCI bus with 128-bit graphics accelerator
MPEG compatible
Zoomed video-ready
Touchpad pointing device
Microphone and 16-bit stereo sound
2-way infrared port
Modular floppy drive
Microsoft Windows 95 and MS Plus!
5-year/1-year Micron limited warranty

$2,249
Bus. Lease $77/mo.

Micron TransPort XKE

STANDARD FEATURES
512KB pipeline burst cache
128-bit, 2MB DRAM graphics
20X modular CD-ROM drive with AutoPlay™ technology
Pick-a-Point dual pointing devices
Microphone and 16-bit stereo sound
Integrated 33.6 Kbps modem, full duplex
CardBus- and zoomed video
2 infrared ports, S-video, NTSC, game and MIDI port
Management and Executive Travel software pak
2 modular expansion bays
Dragon System NaturallySpeaking voice recognition software
Custom nylon carrying case
Microsoft Windows 95 and MS Plus!
Microsoft Office 97 Small Business Edition
5-year/3-year Micron Power limited warranty

Micron TransPort XKE 200

200MHz Mobile Intel Pentium processor with MMX technology
48MB EDO RAM
3GB removable hard drive
13.3" TFT XGA display

$5,699
Bus. Lease $178/mo.

Micron TransPort XKE 233

233MHz Mobile Intel Pentium processor with MMX technology
48MB EDO RAM
3GB removable hard drive
13.3" TFT XGA display

$5,949
Bus. Lease $187/mo.

Micron TransPort XPE

STANDARD FEATURES
256KB pipeline burst cache
PCI graphics accelerator, 2MB VRAM
8X modular CD-ROM drive
Pick-a-Point™ dual pointing devices
Microphone and 16-bit stereo sound
Motorola Montana 33.6 fax/modem
CardBus- and zoomed video-ready
2 infrared ports, S-video, NTSC, game port
Management and Executive Travel software pak
2 modular expansion bays
Custom nylon carrying case
Microsoft Windows 95 and MS Plus!
Microsoft Office 97 Small Business Edition
5-year/3-year Micron Power limited warranty

Micron TransPort XPE 133

133MHz Mobile Intel Pentium processor with MMX technology
16MB EDO RAM (80MB max.)
1.6GB removable hard drive
12.1" active matrix color display, 800x600

$2,999
Bus. Lease $102/mo.

Micron TransPort XPE 150

150MHz Mobile Intel Pentium processor with MMX technology
32MB EDO RAM (80MB max.)
1.6GB removable hard drive
12.1" active matrix color display, 800x600

$3,299
Bus. Lease $112/mo.

Micron TransPort XPE 166

166MHz Mobile Intel Pentium processor with MMX technology
32MB EDO RAM (80MB max.)
2.1GB removable hard drive
12.1" active matrix color display, 800x600

$3,599
Bus. Lease $123/mo

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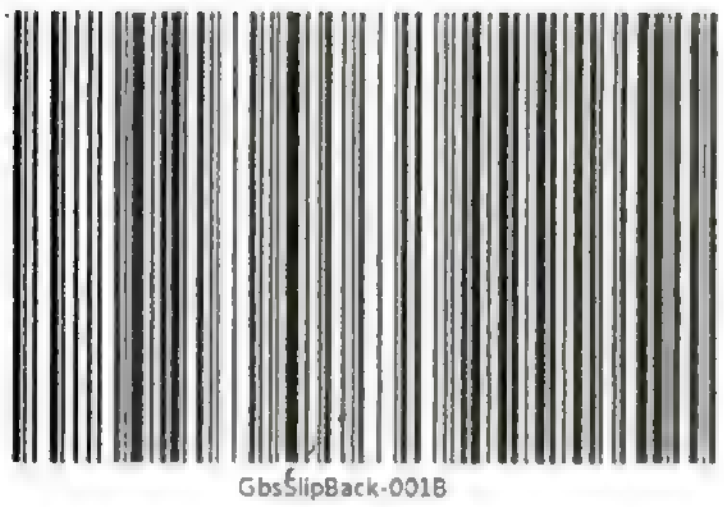
1. Follow instructions on the other side

Inverted Back



Back

1. Follow instructions on the other side

Performance Desktop Solutions

Millennia® MME

STANDARD FEATURES
512KB pipeline burst cashe, flash BIOS
Integrated 100MB Iomega Zip drive, 3.5" floppy drive
24X variable speed EIDE CD-ROM drive
32 voice wavetable stereo sound with AV009 speakers
USR Sportster 56K x2 data/fax modem*
PCI 64-bit 3D video, MPEG, 4MB EDO DRAM
Microsoft® Intellimouse™, USB connections
Microsoft Windows® 95 and MS® Plus!, Microsoft Office 97 Special Business Edition
Choice of Micron Software Solutions Pak
5-year/3 year Micron Power℠ limited warranty

Millennia MME 166

Intel 166MHz Pentium® processor with MMX™ technology
16MB SDRAM
3.2GB Ultra ATA hard drive
15" Micron 500FGx, .28dp (13.7" display)

$1,699
Bus. Lease $58/mo.

Millennia MME 200

Intel 200MHz Pentium processor with MMX technology
48MB SDRAM
4GB Ultra ATA hard drive
17" Micron 700FGx, .26dp (16" display)

$2,249
Bus. Lease $77/mo.

Millennia MME 233

Intel 233MHz Pentium processor with MMX technology
64MB SDRAM
6.4GB Ultra ATA hard drive
17" Micron 700FGx, .26dp (16" display)

$2,599
Bus. Lease $89/mo.

Micron Software Solutions Paks

Quicken Financial Pak: Quicken Deluxe, Family Lawyer, Parent's Guide to Money, Financial Planner†

EdVenture Pak: Includes children's educational and entertainment software, age 3-10†

Home Productivity Pak: Family Doctor, Comptons Encyclopedia 1997, Mavis Beacon Teaches Typing, Printshop Ensemble 3, Net Nanny, Crayola Magic 3D†

Multimedia Xcitement Pak: Includes great multimedia titles the whole family will love! Call for details on titles.

Millennia XKU

STANDARD FEATURES
82440LX chipset
512KB internal L2 cashe, 2MB BIOS
Integrated 100MB Iomega Zip drive, 3.5" floppy drive
24X variable speed EIDE CD-ROM drive
32 voice wavetable stereo sound with Advent 009 speakers and subwoofer
USR Sportster 56K x2 data/fax modem*
Diamond Viper V330 128-bit 3D video with 4MB SGRAM
Microsoft Intellimouse, USB connections
Microsoft Windows 95 and MS Plus!, Microsoft Office 97 Special Business Edition
Choice of Micron Software Solutions Pak
5-year/3 year Micron Power limited warranty

Millennia XKU 266

Intel 266MHz Pentium II processor (features MMX technology)
64MB SDRAM
6.4GB Ultra ATA hard drive
17" Micron 700FGx, .26dp (16" display)

$3,099
Bus. Lease $106/mo.

Millennia XKU 300

Intel 300MHz Pentium II processor (features MMX technology)
128MB SDRAM
8.4GB Ultra ATA hard drive
17" Micron 700FGx, .26dp (16" display)

$3,999
Bus. Lease $136/mo.

Fusion 3D Option Pak

DVD-ROM, **DVD software
E4 Cool DVD PCI decoder card: 6 channel AC-3 to 2 channel out capability, SPDIF output (digital audio out)
AWE 64 ISA sound card
Cambridge SoundWorks/MicroWorks - 2 speaker satellite with subwoofer stereo system
Monster 3D graphics card with 4MB memory
Fusion 3D game pak: Mech Warrior 2: Mercenaries 3Dfx version, AH-64 Longbow, U.S. Navy Fighters '97, Command & Conquer, Formula 1 3Dfx Edition
MS Sidewinder™ Pro Joystick

MME add $699
XKU add $549

**The DVD ROM drive will be removed upon the purchase of the DVD upgrade

MMX intel inside pentium PROCESSOR

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STANDARD FEATURES
12/20X variable speed SCSI CD-ROM drive
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Wavetable stereo sound with speakers
Fast Ethernet 10/100 PCI network adapter
Microsoft Intellimouse
Microsoft Windows NT Workstation
19" Hitachi SuperScan CM751(18" display) .26dp color monitor
Optional support for dual monitors
5-year/3 year Micron Power limited warranty

Powerdigm XLI

Dual Intel 200MHz Pentium Pro processors
64MB ECC EDO RAM
Memory upgradable to 512MB ECC EDO RAM
Number Nine Revolution 3D video card, 4MB WRAM

$4,899
Bus. Lease $167/mo.

Powerdigm XSU

Samurai™ Chip set
Dual Intel 300MHz Pentium II processors
64MB ECC SDRAM
Memory upgradable to 1GB ECC SDRAM
Fire GL 1000 pro 8MB 66MHz PCI Open GL Professional 3D accelerators

$6,199
Bus. Lease $195/mo.

MMX™ intel inside pentium II

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Other Systems Options

MultiMedia Options

AWE 64 ISA Sound Card upgrade	$99
Advent AV370 Powered Partners stereo speakers with subwoofer	$199
Microsoft SideWinder™ 3D Pro joystick	$59
Microsoft SideWinder gamepad	$39

Storage/Media Options

Adaptec 2940U Ultra SCSI Fast-20 controller (upgrade from system with standard Ultra SCSI Fast-20 controller)	$100
Plextor 12/20 Plex 3MB/sec SCSI internal CD-ROM drive (upgrade from system with standard EIDE CD-ROM drive)	$100
Iomega Jaz SCSI drive with 1GB removable cartridge	$299
Iomega Zip IDE drive with 100MB removable cartridge	$99
Iomega 6-pack of 100MB Zip cartridges	$99
Iomega 3-pack of 100MB Zip cartridges	$49
Sony 4/8GB SCSI DDS-2 tape backup drive with tape and software	$899
Cheyenne ARCserver with InocuLAN	$499

Display/Video Options

17" Hitachi SuperScan CM630 (15.9" display) .26dp monitor[2]	$100
19" Hitachi SuperScan CM751 (18" display) .26dp monitor[2]	$300
21" Hitachi SuperScan CM801 (20.0" display) .26dp monitor[2]	$650

Software Options

Small Business Essentials: QuickBooks, Visio, Norton AntiVirus, Astound, Focal Point, American Yellow Pages	$249
CorelDRAW 7 (full retail version)	$299
Corel WebMaster Suite (full retail version)	$99

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HP DeskJet 870Cxi printer	$419
HP LaserJet 6Lxi printer	$429
HP LaserJet 6P printer	$799

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HP Scanjet 5p flatbed scanner	$309
HP Scanjet 6100C	$799

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33.6 external data/fax modem	$299
56Kbps technology modem* upgrade	$99

Server Extended Service Options

2nd and 3rd year next-business-day[3] on-site service coverage[4]	$99
4-Hour response[5] on-site service coverage[4] (8am - 5pm, M-F), 3 year	$798
4-Hour response[5] on-site service coverage[4] (24 hours, 7 days per week), 3 year	$998

Other service options may be available, ask your system consultant

Extended Desktop Service Options

Optional 1st year on-site service[3] coverage included	
2nd year on-site service[4] coverage	$79
2nd and 3rd year on-site service[4] coverage	$99

Other service options may be available, ask your system consultant

Extended VLX Notebook Service Options

2nd and 3rd year parts and labor; 3-business-day turnaround for 3 years[6]	$269
2nd and 3rd year parts and labor; 7-business-day turnaround for 3 years[6]	$209

TransPort Options

Micron Executive™ desktop package: matching black 17" monitor (15.8" display), mouse, mousepad and keyboard (can be used with or without MicronDock. Available on XKE and XPE models only.)	$699

Other Options

APC Per7T surge suppressor	$39
APC Pro7T surge suppressor	$59
Microsoft Natural Keyboard (upgrade from standard keyboard)	$49

[1] Requires SCSI host adapter
[2] Upgrade from systems with standard Macron 17" 17FGx color monitor
[3] 1st year on-site service is available in the United States and in limited areas in Canada from third-party service provider per customer's agreement with provider
[4] 2nd year and 2nd and 3rd year offerings are available in the United States only. Extended services, if purchased after system shipment may have a higher cost.
[5] Service will be scheduled whenever possible, for the next business day after parts are received by the customer
[6] Available in certain locations, ask your system consultant for details
Some options and accessories available with system purchase only

*Maximum transmission speed of up to 56Kbps when downloading data and 33.6Kbps when uploading. However, actual performance is dependent upon numerous factors and observed transfer rates may be less than the maximum potentials.

Available only on Millennia systems with Microsoft Windows 95

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30 days of free Micron-supplied software support for Micron desktop systems; 3 optional network operating system incident resolutions included for Micron server systems
30-day money back policy
24-hour technical support

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Proxima Corp.

Desktop Projector 9200

PC MAGAZINE EDITORS' CHOICE

Proxima Corp.'s Desktop Projector 9200 has the same list price as many of the other projectors in this roundup: $11,999. And like four of the five projectors reviewed here, the Desktop Projector 9200 uses three-panel polysilicon technology. It has many of the same basic features as its competitors (without any particularly flashy features). But where the Desktop Projector 9200 really distinguishes itself is in the overall quality and brightness of its image. The unit produced the brightest images with generally good quality, and that's why we award it our Editors' Choice.

At 14 pounds, this unit is light enough to be considered a portable projector. The cooling fan is quieter than most, and the well-marked connectors make it easy to set up. Powered zoom and focus make it a snap to adjust the image size. If there is a drawback to the setup process, it is that you must change levels in the on-screen menu system—even for brightness and contrast—which can be a bit tedious. More direct access to some of these settings would speed the configuration process.

The only problem we encountered during testing was that the projector didn't handle an interlaced signal properly. Most users don't use interlaced signals to avoid flicker, so this is not likely to be a problem. Our evaluation unit had two pixel defects in the image; Proxima does have a policy for replacement based on pixel defects, but it is complex and based on the specification from the LCD panel manufacturer.

On our performance tests, the projector produced the brightest output at 459 lumens, which is close to its 500 ANSI lumen rating. The Brightness Variance score was 1.2, which is not as good as some competitors, and it confirms our observation of some faintly brighter vertical stripes on the screen. The Contrast score of 67 was the second-best score on the whole, and it contributes to the sharp quality of the images.

Proxima backs the projector with a one-year warranty (excluding the lamp) and provides 72-hour replacement. The company offers an optional soft carrying case for $369 and a hard case for $449.

The image quality—in terms of focus, colors, and gradations—was excellent. The image is so bright that a color image is strong and saturated even when the screen is facing a window filled with afternoon sunshine.

The winning combination of image brightness and quality, coupled with the projector's portability, makes it the clear winner in this group.

Sayett Production Products, a division of MediaShow Inc.

MediaShow 1024

MediaShow is one of the oldest companies in the LCD projection business, having made one of the first LCD panels for overhead projectors. Unfortunately, the MediaShow 1024 ($11,450 list) is a bit old-fashioned for this market, especially given the trend toward portable projectors. Its large size and low performance leave it ill-equipped to compete with the other projectors in this group.

To start with, the projector is huge compared with the others; the footprint is nearly a foot and a half square. This large size also translates into more weight, and its 26 pounds will discourage you from ever taking it on the road. The main reason for the large size is that it relies on different technology than the others. All the other projectors in this group use three separate 1.3-inch polysilicon panels (one each for red, green, and blue), and the images are optically combined. The MediaShow uses a single 10.4-inch TFT panel.

Installation is made more difficult by the projector's lack of features. The unit is the only one without any zoom feature, and the fixed focal length of the lens means that the projector must be in a single location to fill a screen of a given size. The lens also uses a manual focus. The large enclosure has a relatively noisy cooling fan, and there is considerable light leakage compared with other designs seen here.

The two connectors on the projector are not labeled, and there is no illustration in the manual to guide you (though the correct connectors are described in the text). Adjusting the image is made difficult by the lengthy and nonintuitive on-screen menus, and the thin manual is not much help at explaining the many different options that are available. There is a spring-loaded leg in the front to control the elevation of the image, but this is difficult to use. On the plus side, the MediaShow is the only projector in this roundup to include an easy-to-use manual keystone adjustment.

In terms of performance, the MediaShow 1024 was squarely at the bottom of the pack. It posted the second-lowest Brightness test score at 211 lumens. This is adequate for black and white under normal room lighting, but you'll need to dim the lights for color presentations. The White/Black Contrast score was a low 32,

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To make it easy for you to experience x2 technology now, we're introducing "x2 Delivers More," a special program that will show you why buying a U.S. Robotics 56K modem today makes so much sense.

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We're offering a $50 (US) mail-in rebate when you purchase a U.S. Robotics 56K desktop modem with x2 technology by 1/17/98. It's a great way to help you get the most out of the Internet.

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U.S. Robotics

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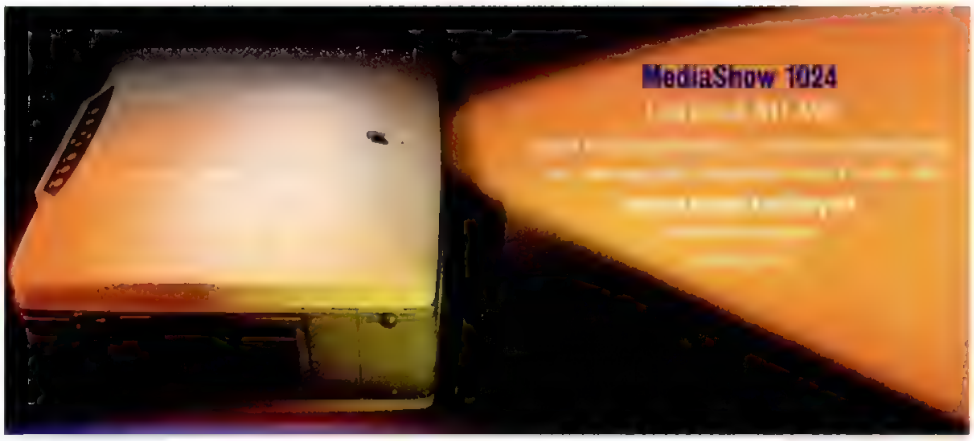
U.S. Robotics. From the leader in networking. 3Com

which is caused by the relatively bright "black" level of the image. And the Brightness Variance score of 1.7 was by far the worst score of the group, confirming the observation that the image's lighting was extremely uneven.

In addition, the projector had three bright pixel defects that were more noticeable than most. The company does have one of the best policies on pixel defects, though: It will replace the unit if there are more than three defects or if there are two within two inches of each other on the panel. Warranty repairs are completed with a three-to-five-business-day turnaround.



The Sayett MediaShow 1024 is not competitive with the field of products featured in this roundup. The projector's poor image quality, difficult interface, and cumbersome size and weight are all working against it. In addition, there is no price advantage to buying the MediaShow as compared with more capable and portable models. PC

WHITEBOARDS

Affordable Collaboration

MicroTouch's new Ibid line makes PC whiteboards affordable for your cubicle or conference room.

By Ben Z. Gottesman

Although many people were reluctant to forsake the thrill of clapping erasers together, dry-erase whiteboards have quickly become the large-format writing surface of choice. And with MicroTouch's Ibid line, the company has overcome the price barriers associated with the earliest PC whiteboards.

The Ibid line of whiteboards is currently made up of the $599 2- by 3-foot Ibid 100, the $599 3- by 2-foot Ibid 150, the $999 3- by 4-foot Ibid 300, and the $1,349 3- by 4-foot Ibid 400 (all list prices). The Ibid 100 and 150 are perfect sizes for cubicles or small offices, while the larger boards are better suited for conference rooms.

Each board attaches to a PC via a supplied serial cable. Upon installation, the installation program searches for your board and configures the Ibid software for the appropriate COM port. (We had some problems connecting an IBM ThinkPad 560E, because of a conflict with its infrared port, but MicroTouch's Web site has information about how to fix this problem.) The Ibid software will launch every time you start Windows. Start writing on the board and the software is there to record your marks.

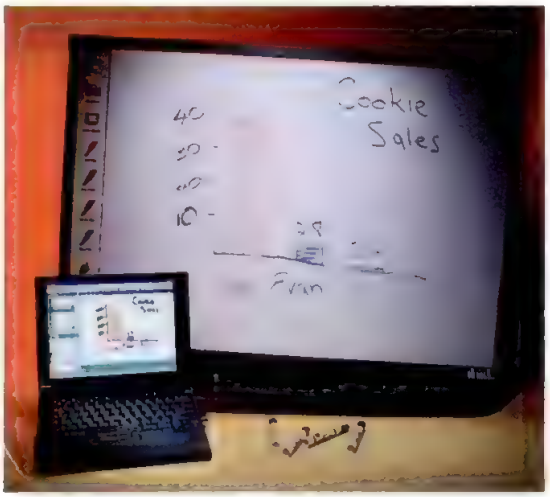
The units ship with four standard dry-erase markers (red, blue, green, and black). You press a button on the board to indicate your pen's color, so you don't need special markers. Unfortunately, since it is easy to forget to press the button when you're switching pens, your computer image may end up in the wrong colors.

To erase anything, you also need to press a button so that the software can interpret your strokes. There are buttons provided for "thin erase" (using the eraser's side), "wide erase" (using the eraser's face), "erase all," saving a snapshot of the image, and printing the image.

The larger Ibid 300 and Ibid 400 add buttons for a configurable pen (so that you can add different-color markers), "snapshot forward" and "snapshot backward," and "show board," which brings the Ibid software to the foreground on your monitor.

The Ibid 300 and 400 differ from each other only in their software, but that's a significant difference. The Ibid 400's software lets you tile up to four boards together (4- by 1-foot or 2- by 2-foot) and have them appear on the computer as one board. In addition, when you use the board as a backdrop for an LCD projector, you can actually use your finger as a mouse in any Windows application. And with the Ibid 400, you can project an overlay image of a form and fill it out on the board and it will look appropriate in the software application. (Note that MicroTouch currently doesn't offer a software upgrade for Ibid 300 users.)

PC whiteboards are nothing new, but MicroTouch has hit a magic price with its Ibid line. The landscape-oriented Ibid 100 or the portrait-oriented Ibid 150 will be ideal for small offices. And in the conference room, the Ibid 300 and 400 will prove invaluable, although we recommend the Ibid 400 for its additional features.



Ibid whiteboards. List prices: Ibid 100, $499; Ibid 150, $599; Ibid 300, $999; Ibid 400, $1,349. Requires: 486/33 PC or better, Microsoft Windows 3.*x*, 95, or NT 3.51 or 4.0. MicroTouch Systems Inc., Methuen, MA; 888-388-4243; www.microtouch.com. *Circle 407 on reader service card.*

PHOTOGRAPH BY THOM O'CONNOR

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PC MAGAZINE JULY 1997

SERVICE AND RELIABILITY SURVEY

When it comes to service and reliability, who's the one notebook maker you can truly count on? According to the nearly 8,500 people who responded to *PC Magazine*'s 10th Annual Service and Reliability Survey, there is only one. (Impressive, considering they rated some 3,800 notebooks from 15 vendors, isn't it?) How did we earn the only "A"? Over the last year, our users reported better than average scores on four key measures: satisfaction with reliability, repair experience, and technical support; and the need for recent repairs. And this is a trend we're likely to continue with our new line of Dell® Inspiron™ notebooks. Visit us on the Web or give us a call.

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PROJECT MANAGEMENT SOFTWARE

A Tool for Dilbert's Boss

Microsoft takes another step toward bringing project management to a much wider audience.

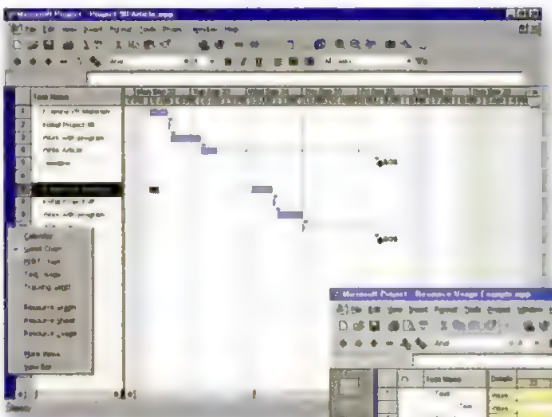
By Will Fastie

One of the things Microsoft does extremely well is put attractive and approachable user interfaces on its products. Microsoft's newest project management tool, Project 98, continues this tradition as the company proceeds with its efforts to expand this market. The improvements in usability are the strongest new features in a product that continues to evolve splendidly.

Microsoft touts its Project 98 as a member of the Office 97 family. This is immediately evident in Project's now familiar Office 97 splash screen, which contains a puzzle-piece logo and the legend "Microsoft Office Family Member". It is further evident in the interface, which now includes such items as command bars and new menu styles introduced with Office 97. Project 98 is also Office Assistant-aware, so Clippy is just a mouse-click away.

One important change in the user interface is that a mouse is absolutely essential for using Project 98. This might seem a silly thing to say in a mature Windows market, but other major productivity applications, regardless of vendor, continue to have extensive arrays of keyboard shortcuts. Project 98 does not. To use it effectively, you must be comfortable with both left and right mouse-click operations; right-click pop-up menus have been added in some places and expanded in others. Project 98 even supports Microsoft's IntelliMouse for more rapid schedule navigation.

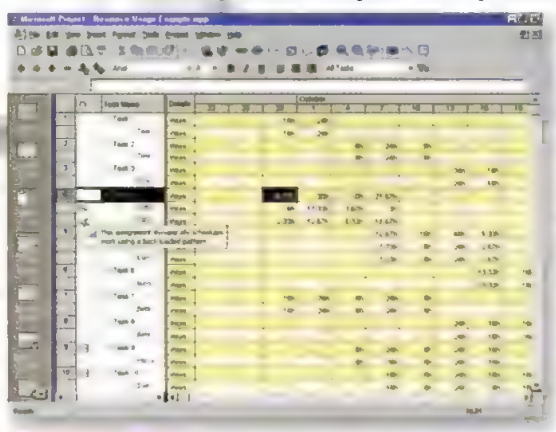
Perhaps the single most important improvement in Project 98 is the ability to split a task—to account for the most common real-life situations, such as an interruption of work. Tasks can be split through the middle, with part of the task happening on one day and the other part occurring several days later. Project 98 allows as many splits in a given task as the user likes; a powerful feature compared to the previous, tedious process of creating a new task, then dividing the work into two pieces. In Project 98, we accomplished the split visually and easily with a few clicks and drags.



SHAREWARE: *Project 98's most compelling new feature is the ability to split a task if work is interrupted, as this simple project plan illustrates.*

The second big improvement is the addition of resource contouring. Previous assignment of a resource (such as a person) to a task resulted in a flat allocation of time. If 8 hours of the resource were available per day, then 8 hours were applied to each day in the task. Any other allocation required manual adjustment. Contours are predefined work patterns. The Back Loaded contour allocates less time to the beginning of the task and more to the end, with the amount of time rising over the course of the task. Contours, like splits, cater to real life. For example, programmers are often finishing one project as they begin another; the old project tapers off while the new one ramps up. Contours allow the project planner to design such patterns quickly, without a lot of fiddling with numbers.

Project management can be intimidating, especially to someone new to this kind of responsibility, so Microsoft has attempted to improve Project 98's approachability with several tutorials. Learn While You Work provides a number of specific lessons that guide users while they are working on actual projects. There are also two slide shows: Quick Preview and Microsoft Project 101. All tutorial assistance is at a basic level, clearly designed for first-time project managers.



PROJECT PLANNING: *This Task Usage view example shows resources by task and illustrates contours.*

In keeping with today's emphasis on the Web, Project 98 includes Personal Web Server and Microsoft Internet Explorer 3.01 to enable HTML publishing. Personal Web Server allows an individual PC to provide HTTP and FTP services, so the pages created by Project 98 can be viewed by others, perhaps over a corporate intranet. On our tests, it was a simple matter to save various aspects of a project to HTML pages, which we could then view with our Web browser. This is a good extension for Project 98, because it allows project information to become disseminated quickly to team members for review (it also allows managers to control what information is distributed).

For the more technically adept, Project 98 includes Visual Basic for Applications (VBA) as its scripting tool, just like the other members of Office 97. Project has never been programmable before, so the availability of a full-fledged programming language will likely spur custom project management solutions, including third-party add-ons.

There are literally scores of other improvements and additions to Project 98. But it is ease of use and approachability that will endear this new version to users.

Project 98. List price: $499. Requires: 486 or faster processor; 12MB RAM, 20MB to 40MB hard disk space; Microsoft Windows 95, Microsoft Windows NT 3.51 with Service Pack 5 or later, or Microsoft Windows NT 4.0 with Service Pack 2 or later; VGA graphics; CD-ROM drive; mouse. Microsoft Corp., Redmond, WA; 800-426-9400, 206-882-8080, www.microsoft.com. *Circle 408 on reader service card.*

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LARGE-FORMAT PRINTERS

The Bigger Picture

Large-format printers can produce poster-size output and can even cut out decal designs.

By M. David Stone

By nature, large-format printers—by which we mean printers that can produce D-size (22- by 34-inch), E-size (34- by 44-inch), or larger prints—are special-purpose beasts. Many businesses will never need one, which is fortunate. With prices as high as $11,995 (list) for Hewlett-Packard's DesignJet 2500CP, it isn't every business or corporate department that would want to pay for one. But the DesignJet's impressive, high-quality output may make it worth the price.

A computer-controlled sign-cutting machine is even more of a special-purpose product. Roland Digital Group's *CammJet* CJ70 ($20,000 street) is a large-format printer that lets you cut out text or graphic designs in the top layer of vinyl sign material. You will find that both the cutting and printing work as promised.

It is not as difficult to justify buying a large-format printer as you might think. If you need large-format prints even occasionally—for presentations, say, or for motivational posters—paying someone to print them for you can quickly add up. With service bureaus typically charging approximately $200 a pop, it might be cheaper over time to buy your own printer. And instead of waiting a day or more for a service bureau to finish your printouts, you will get them in just an hour or so with a printer of your own.

HP DESIGNJET 2500CP

Some large-format printers are designed with CAD line drawings in mind. One look at the DesignJet 2500CP's full-color output, however, will convince you that this printer is designed for graphic and photographic images, not line drawings.

This printer offers several key features, including 600- by 600-dpi resolution; 20MB RAM standard (and as tested), which can be expanded to 68MB RAM; built-in Adobe PostScript (Level 2 was tested with 35 Adobe Type 1 fonts, but Level 3—which has 136 fonts—will be available by the time you read this); and a 2GB hard disk that can store downloaded fonts, queue print jobs, and provide virtual memory for large print jobs. For the occasional line drawing, the printer supports HP-GL/2 and HP RTL (HP's plotter languages). The DesignJet also comes with AutoCAD drivers as well as an Adobe PostScript driver.

Thanks to the DesignJet's large-capacity ink system, you can leave the printer unattended without constantly checking to see whether it's running out of a particular ink color. The vendor estimates you can print 400 D-size prints with each one-color cartridge and print head. As long as you use specified 3M paper and coatings, HP guarantees that your prints will last outdoors for as long as two years.

DETAILS: *The HP DesignJet 2500CP produces near-photographic quality prints, even when viewed up close.*

The paper rolls are three feet wide, and the printer can print an image up to 150 feet long. If you've ever used a large-format printer, you already know that loading wide paper can be a challenge. Fortunately, the DesignJet's front-panel LCD gives you step-by-step instructions as you install the paper.

Once you've loaded the paper, the DesignJet goes through a self-adjustment routine that includes printing a test pattern, scanning it, and using the results to align the print heads and check for clogged nozzles. If it finds any clogged nozzles, the printer automatically adjusts itself to use redundant nozzles that aren't clogged. It runs this self-check every ten print jobs by default. A similar routine calibrates color automatically when you change ink or media types.

The DesignJet also has the ability to resample images. For any given printer resolution and dithering scheme, there's a minimum image resolution for best output. If the image you start with has too low a resolution, you can use a program like Adobe Photoshop to add more pixels. With a large-format printer, however, the resulting file size will be so large (in megabytes) that print time will increase significantly. The DesignJet deals with this problem by resampling the image at the printer.

One last feature worth mentioning is nesting. If this feature is turned on when you send several jobs to the printer in quick succession, the DesignJet will automatically position the images to use up the least amount of paper; it may line up two, three, or more print jobs across the paper.

On our tests, the DesignJet delivered high-quality, large-size prints, with photos that approached photographic quality even when they were seen from close range. It also did well with the graphics portion of a PC Labs test

COLORS: *The DesignJet's large-capacity ink system.*

PHOTOGRAPHY BY THOM O'CONNOR

image, producing brilliant, fully saturated colors and appropriately smooth shading in gradients. Print time for the test image at E size was 1 hour and 21 minutes. The DesignJet printed the same image in draft mode in about 30 minutes.

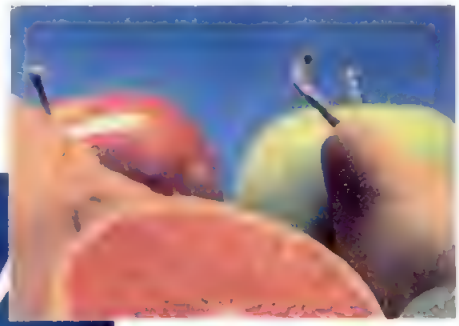
According to Hewlett-Packard, the typical printing cost is 40 cents to $1.25 per square foot, depending on the paper and ink you use. HP offers two choices of ink (dye-based and UV-resistant for outdoor use) and several choices of paper (including coated and glossy papers and film). Still other types of media are available from 3M. Hewlett-Packard also includes one year of on-site service with the unit.

The DesignJet 2500CP offers an impressive combination of output quality and ease of use. Not only does this printer have built-in smarts, it is also a smart choice if you have need of a large-format printer.

ROLAND DIGITAL GROUP CAMM*JET* CJ70

Roland's Camm*Jet* CJ70 can print large-format images—up to 49.5 inches by 82 feet—at near-photographic quality, thanks in large part to its 360-dpi Epson print head. But if large-format printing is all you'll use it for, you'll be ignoring its key strength.

With the Camm*Jet*, Roland has combined cutting and printing in a single unit. It's easy to do things like print a flower on vinyl with adhesive backing, cut around the irregular edges, and then peel off the flower for use as a decal or sign. On our tests, we printed several rows of a *PC Magazine* logo and cut out each logo. True to its promise, the unit printed the logos, then rolled the paper back into the printer and cut out the logos with unerring precision.



PICTURESQUE: *This colorful, high-quality output from the Roland Digital Group's CammJet CJ70 is attributable to the printer's 360-dpi Epson print head.*

The Camm*Jet* measures roughly 45 by 84 by 28 inches (HLD) and weighs 243 pounds, complete with stand. Setup by a Roland dealer is included in the price, along with an introduction on using the printer and cutter and one year of on-site service. The unit has both a parallel port and serial port, but it lacks a network port. It also includes a Windows driver (for printing and cutting) and PrintCUT, a program designed to print and cut without going through the Windows driver.

The paper feed can handle paper up to 54 inches wide, but standard rolls are only 50 inches. Although the paper can be somewhat difficult to load, it's a skill you can quickly aquire. According to Roland, each ink cartridge is good for 57 D-size pages (based on 120 percent ink coverage with an average of 30 percent of each color). The printer then gives off an audible warning when a cartridge is empty and pauses printing, allowing you the chance to load more ink without ruining the current print job.

CUT IT OUT: *The Roland CammJet can cut around images in order to make decals.*

The typical cost for prints is somewhere between $1.40 to $3.40 per square foot, depending on the print medium you use. The choices include premium bond paper, polyester film, canvas, and vinyl, which absorbs the ink to produce water-resistant prints. Roland claims that its pigment-based ink is UV-resistant for up to a full year.

On our tests, the Camm*Jet*'s output proved to be of surprisingly high quality for the resolution. We saw some posterization (a sudden change in shading that should change gradually), but Roland says that this happened because the default color-correction setting was the wrong choice for the test image. Print time for the PC Labs test image at E size was 1 hour and 9 minutes.

The Roland Camm*Jet* CJ70 comes up a little short on fit-and-finish issues, however. For example, the arrows on the front panel, which advance the paper and roll it back, are the opposite of what you would expect to find. In order to advance the paper, you press the arrow pointing back toward the paper roll. And to make it go backward, you just press the arrow that is pointing away from the roll toward the front end of the machine. These are relatively minor quibbles, however. On the whole, the Camm*Jet* CJ70 does what it promises and does it well.

HP DesignJet 2500CP. List price: $11,995. Requires: Parallel port or Ethernet connection, Microsoft Windows 95 or Macintosh OS, 4MB RAM, 1.4MB hard disk space. Hewlett-Packard Co., San Diego, CA; 800-851-1170, 208-323-2551, fax: 800-231-9300; www.hp.com/go/designjet. *Circle 401 on reader service card.*

Camm*Jet* CJ70. Street price: $20,000. Requires: Parallel port, Microsoft Windows 3.1 or Windows 95, 32MB RAM, 15MB hard disk space. Roland Digital Group, Irvine, CA; 800-542-2307, 714-727-2100, fax: 717-727-2112; www.cammjet.com. *Circle 402 on reader service card.*

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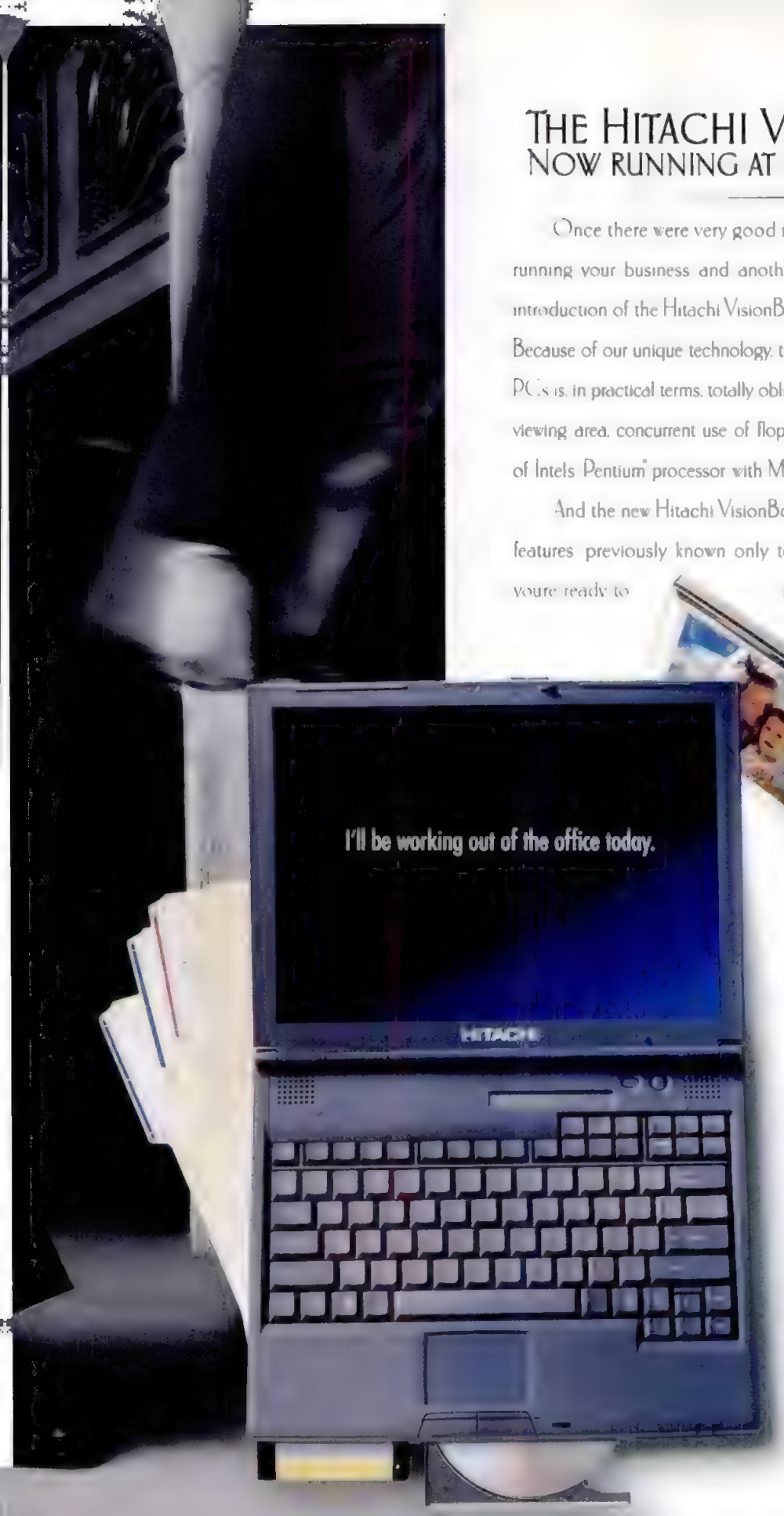

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UTILITIES

Internet Uninstaller

Quarterdeck's CleanSweep Deluxe boasts new Internet cleanup features and faster disk scanning.

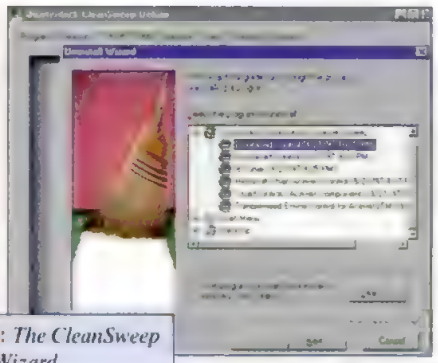
By Edward Mendelson

Quarterdeck's CleanSweep Deluxe improves on CleanSweep 3.0, the application remover that most Windows experts prefer. For most users, the new Internet cleanup features and improved speed will make it worth the $20 upgrade.

Like Version 3.0, CleanSweep Deluxe ($60 street price or $50 with the mail-in rebate) removes applications thoroughly as long as you let the program monitor their installation. And thanks to an improved database of common applications, CleanSweep Deluxe is almost as effective at removing applications you installed before it was on your system. Disk-scanning speed is notably improved and far surpasses that of the sluggish Cybermedia Uninstaller 4.5.

A tabbed interface lets you remove applications, delete redundant and unused DLL and other files, and clean out references to nonexistent files in the Windows registry. The new version adds an "Internet Sweep" tab, which lets you clean out your browser's cache files, eliminate unwanted cookies, remove browser plug-ins, get rid of ActiveX controls, and remove OCX and DLL files downloaded by Microsoft Internet Explorer (as long as you have CleanSweep monitor their installation).

If you choose a file or control category to remove, the program displays a color-coded list that indicates which files are safe to extract and which should be removed only if you know what you're doing. By default, the program will let you remove files with green flags only; to delete files with yellow caution flags, you must first change an option setting. CleanSweep makes a backup by default when it purges a set of files, but you can have the program let you decide whether you want to make backups yourself.



TIDYING THINGS UP: *The CleanSweep Deluxe Uninstall Wizard.*

As with the earlier version, a View button allows you to see the lists of files, cookies, and controls. But the cramped window sometimes forces you to scroll in order to see dates and the full names of files. Also, you'll find it awkward to use the View button to see the text of each cookie. CleanSweep Deluxe is smart enough to look for both Microsoft Internet Explorer and Netscape Navigator on your system, and it will clean out caches, cookies, and plug-ins from both browsers.

If you set enough options in CleanSweep, you might inadvertently clean out Windows files you need (although you'd have to ignore the program's many "caution" warnings). So it may not be the right program for reckless or uninformed users. But Windows experts will find it unmatched in its power to reclaim disk space and clear out the digital dust bunnies that accumulate under every Windows desktop.

CleanSweep Deluxe. Street price: $60 ($50 with rebate). Requires: Microsoft Windows 95 or Windows NT 4.0, 8MB RAM (16MB recommended), 8 to 10MB hard disk space. Quarterdeck Corp., Marina del Rey, CA; 800-354-3222, 310-309-3700; www.quarterdeck.com. *Circle 403 on reader service card.*

ONLINE SERVICES

A Front Door to the Web

CNET's Snap! Online takes direct aim at AOL and Yahoo.

By Don Willmott

If Web usage is going to continue to grow at the rates we're currently experiencing, there will have to be easy-to-use entry points for the millions of mass-market consumers who have yet to make the leap. That's the theory behind Snap Online! (*www.snap.com*), an Internet entry point created by CNET that feels like a combination of America Online and a Yahoo-like Internet directory.

IT'S A . . . *Snap! Online's home page is a look at what's new on the Web.*

Available from its own URL, as a premier channel of Microsoft's Internet Explorer 4.0, or from seven Internet service providers that will use it as a home screen, Snap! Online packages the Web as a collection of 13 highly edited channels, each with its own headlines, stories, links, and search tools. As you explore News, Living, Entertainment, Business, Sports, or Computing, for example, it's hard not be reminded of America Online's channel structure. The difference is that Snap! Online is on the Web itself and is free.

The colorful, somewhat frenetic home page promotes what's new on the channels each day, and a handy "week in review" feature lets you go back in time to see what was highlighted on the home page during the past week. Each of the 13 channels has its own home page, complete with headlines, highlights, searching, and related links. Drill down to an individual story and you get even more related links.

Snap! Online asks only for your ZIP code; that way, it can customize itself to give you your local weather and lottery numbers. You can also pick stocks to watch and type in your birthdate to get your horoscope.

Searching technology on Snap! Online comes from Infoseek. There are directories of people and mapping tools available as well. Shareware fans will also find links to lots of software downloads.

Net vets may quickly tire of some of Snap! Online's candy-colored clutter. With so many links jumping out at you from every corner of the screen, you may wish for a little more editing. But for Web novices, Snap! Online is an inviting and useful way to get lots of exposure to all the Web has to offer.

Snap! Online. Price: Free. CNET Inc., San Francisco, CA; 415-395-7800. www.snap.com. *Circle 404 on reader service card.*

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DEVELOPMENT TOOLS

Building With Beans

Visual Café for Java 2.0 is an attractive package for Java database developers.

By Richard V. Dragan

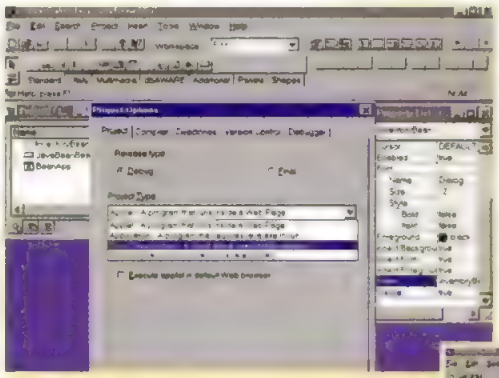
Symantec's Visual Café for Java 2.0 Database Development Edition offers an improved development environment centering around extensive JavaBeans component support, improved compiler technology, and an appealing bundle of Internet tools. It all helps make this package an attractive option for Java database developers.

Visual Café 2.0 comes in three flavors: the Database Development Edition ($500 street) reviewed here (with the full enterprise-departmental database development tools), the Professional Development Edition ($300 street), and the Web Development Edition ($100 street) for the personal Web developer. Each edition provides a different set of tools supporting the basic Visual Café 2.0 development environment.

In our round-up of Java compilers (January 7, 1997), Visual Café 1.0 earned high points for its RAD tools, ease of use, and support for the emerging JavaBeans standard (the component model for Java). Though JavaBeans did not officially debut until Version 1.1 of the Java Development Kit (JDK) was released in early 1997, Symantec used a preliminary version of Beans in the initial release of Visual Café.

Version 2.0 offers support for almost every aspect of Sun's JavaBeans standard. In order to use JDK 1.1 components, you'll need a browser with JDK 1.1 support (Microsoft Internet Explorer 4.0 or Netscape Communicator 4 with an add-on patch, which is included on the CD-ROM).

Visual Café for Java 2.0 bundles over 100 prepackaged components from user-interface objects in a rich variety of shapes and sizes—even multimedia beans are included. This allows Web developers to assemble sophisticated user interfaces out of preexisting components. Moreover, almost all the components are database-aware and can be "bound" to live data on the server. This makes it easy to get to corporate data via the Internet or an intranet.

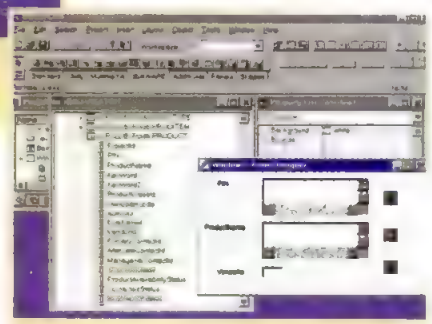


QUICK FIX: *Visual Café for Java 2.0 now supports native code compilation and incremental debugging.*

The new Visual Café Database Development Edition has extensive database support, including its middleware product dbAnywhere. With dbAnywhere, database connections are managed on the server side. Your client application uses dbAnywhere-aware components (or high-level Java classes) to access data. The database support here is excellent, with native drivers for Oracle, Sybase, and Microsoft SQL servers as well as ODBC access to virtually any data source.

The wizard support for working with data is one of Visual Café's strongest features. We were able to design queries and forms visually without writing Java code. There is even a built-in, query-by-example facility.

For high-end users seeking to develop their own JavaBean components, Visual Café offers a few bells and whistles to make the job easier. But you will still need to know a lot about the JavaBeans architecture to build your own bean components. There is a default JavaBean project to get you started with the primitive outline of a bean, but you will need to write your own code. The JAR file wizard, which allows you to manage the files needed for distributing a bean on a Web page, is an excellent tool that developers will likely find indispensable for deploying Beans.



FILLING OUT FORMS: *With Visual Café, you can populate fields on a form using a wide array of data-aware JavaBeans.*

In addition to database connectivity and JavaBean support, Visual Café's compiler and debugging technology takes a significant leap forward with this release. First, there is the ability to generate native Intel *x*86 code from Java applications, which can lead to better performance for corporate intranet applications. On a selection of our JMark 1.02 Java benchmark tests compiled with both options, performance was actually a little slower (by 3 percent) for the native-code version when compared to the standalone applet viewer. It should be noted that real-world browsers will be slower than this. Native code will still offer an improvement for most users.

Another feature sure to be a hit with developers is the debugging technology that lets you make changes to your code on the fly. This "incremental debugging" feature is similar to Visual Basic's or Asymetrix Corp.'s SuperCede. It dismantles the traditional "edit-compile-run" cycle for better productivity.

The Database Development Edition is packaged with all the necessary tools to help get you started creating database–enabled Web sites powered by Java. In addition to the dbAnywhere database server, this edition serves up Netscape FastTrack Server and Netscape Communicator, Visual Page (a Web-page design tool), and Sybase SQL Anywhere, a standalone database server. (Symantec supplies the Java Virtual Machine for Netscape, and the debugging in Visual Café works the best with Netscape browsers.) Other add-ons include a trial version of the Star Base version-control package and a beta version of Netscape's Java Foundation Classes (JFC).

The new-and-improved component (JavaBeans), database connectivity, and compiler technology will make Visual Café worthwhile for Java developers. It improves on an already strong Java development tool and again places it in the forefront of Java compiler technology.

Visual Café for Java 2.0 Database Development Edition. Street price: $500 (upgrade: $99.95 direct). Requires: Pentium/90 CPU or better, 24MB RAM, 60MB hard disk space. Symantec Corp., Cupertino, CA; 800-441-7234, 541-334-6054; cafe.symantec.com. *Circle 411 on reader service card.*

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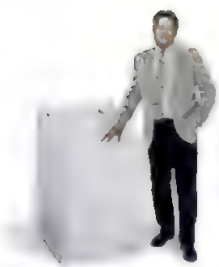

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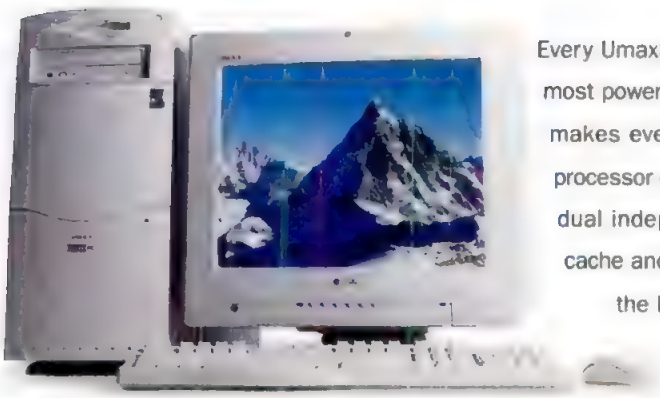

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GRAPHICS UTILITIES

Artistic Compression

Two utilities from Digital Frontiers allow you to reduce image size without sacrificing quality.

By Luisa Simone

Web Focus 2.0, from Digital Frontiers ($159 list), bundles two incredibly useful graphics utilities—HVS ColorGIF 2.0 and HVS JPEG 2.0—in one package. These Adobe-compliant filter and export plug-ins produce the best-looking and fastest-downloading raster images for display or distribution on the Internet.

Unlike most image editors, HVS JPEG 2.0 provides total control over the conversion process. In addition to standard options for progressive JPEG output and 100 compression levels, HVS JPEG lets you choose a preset (or generate a custom) color-analysis table to improve color transitions in specific image types, such as portraits. Most important, filters that soften textures while maintaining edge definition allow you to increase the efficiency of the JPEG compression algorithm and reduce quantization artifacts.

HVS ColorGIF employs the Human Visual Systems algorithm (hence HVS) to bias the color-reduction process in favor of hues to which the human eye is sensitive. This produces a facsimile of a full-color picture with a dramatically reduced color palette.

Version 2.0 allows you to add small amounts of dithering to reduce further the number of colors required. You can also set luma thresholds and gamma values to influence the choice of colors. But to streamline the interface, Digital Frontiers has eliminated chroma-based thresholding, a feature that will be sorely missed by power users.

A powerful new function gives HVS ColorGIF the ability to generate a single optimized palette for a group of images. You can even assign a weighting factor to favor a critical picture. But unless you work with Photoshop (for which Digital Frontiers has supplied an Action script), creating a multipalette requires you to use the plug-in *four* times for each image in the group.

HVS JPEG and HVS ColorGIF both have interactive previews that provide information on quality, file size, and compression ratio. But the lack of a zoom tool means you can't inspect the previews closely enough to find small but significant artifacts.

During testing, we produced GIF and JPEG images that were 20 to 40 percent smaller than the files produced by PhotoShop's standard functions. Even when the file sizes weren't much smaller, the image quality was much better.

Those interested in improving the performance or appearance of Web sites should add HVS Web Focus to their graphics toolkit.

TRUE COLORS: *HVS ColorGIF makes it possible to produce realistic images with a tiny palette.*

HVS Web Focus 2.0. List price: $159. Requires: A host program that supports the Adobe Photoshop 3.0 or better Plug-in Specification. Digital Frontiers, Evanston, IL; fax: 847-869-2053; www.digfrontiers.com. *Circle 410 on reader service card.*

UTILITIES

Way Cool

Cool 3D creates the hottest text effects for Web pages or paper documents.

By Edward Mendelson

Three-dimensional text that spins, bounces, or glows is what you get effortlessly from Ulead's $40 Cool 3D. This single-purpose utility far exceeds all rivals in convenience, flexibility, and Web-readiness. You simply type in your text; select any TrueType font on your system; apply customizable shapes, colors, textures, and camera and lighting angles; and choose optional animation effects from a gallery of customizable presets.

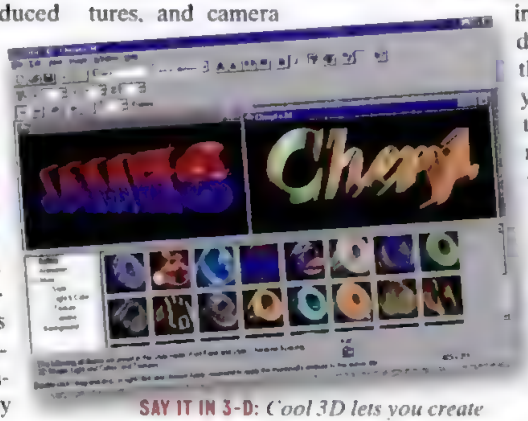
Cool 3D uses Microsoft's DirectX drivers (if you don't have them on your PC), and it uses them for high-speed animation and previews, so producing dazzling effects takes only a few seconds. You can save nonanimated images as .BMP, JPEG, GIF, or .TGA files, and you can save animations as .AVI files or animated GIFs that you can add directly to a Web page.

The easiest way to start is to replace the sample image's text using the text field in the toolbar. Then apply a thumbnail to the image by dragging or double-clicking on the thumbnail. Then use your mouse to rotate the text in three dimensions or click on a toolbar icon to move the text anywhere in the horizontal plane.

You can open a toolbar to modify attributes such as color and lighting; you can also use your own .BMP or JPEG files as the basis for textures or backgrounds. Save any effect as a thumbnail and it will appear in the gallery. You can delete or reorder both the customized and preset effects.

Preset animations include stationary text with animated lighting and text that spins or zooms in and out. When creating your own animations, you apply a preset style to the opening frame and then apply another style to the closing frame; the program generates an animation that shifts from the opening style to the closing one. You can save your custom animation style in the gallery.

One limitation: You can't give different effects and animations to objects in a single image. Rival products such as Crystal Graphics' $149 Flying Fonts Pro have this feature, but they lack Cool 3D's Web-readiness and superb ease of use. Nothing matches Cool 3D for speed, ease, and sheer dazzlement.



SAY IT IN 3-D: *Cool 3D lets you create text that bulges, spins, and shines.*

Cool 3D. Street price: $40. Requires: Microsoft Windows 95, 16MB RAM, 20MB hard disk space. Ulead Systems, Torrance CA; 310-523-9393; www.ulead.com. *Circle 409 on reader service card.*

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VIDEO CAPTURE

Seamless Imaging

Two new software programs from VideoBrush let you create panoramas from a mosaic of images.

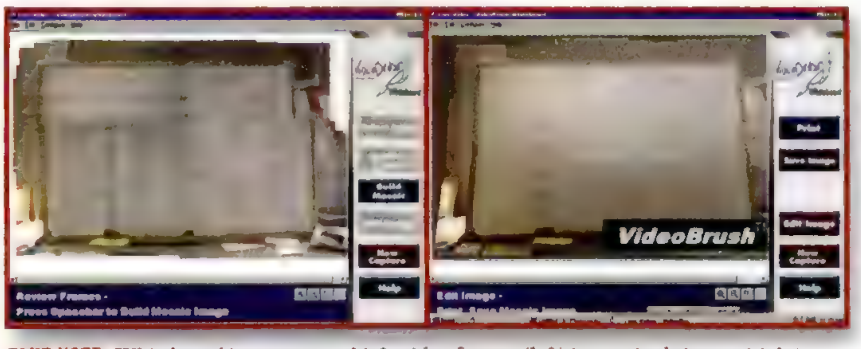
By Jan Ozer

The world is filled with many breathtaking panoramas, but capturing them into a single image has traditionally required an expensive, wide-angle lens or other special equipment. VideoBrush Corp. solves this problem with two new programs: Panorama ($39 list), which creates wide-angle views from video input, and Whiteboard (also $39 list), which uses the same technology to capture information from a whiteboard or other surface. Both produce startlingly high-quality output and are easy to use.

To create images, both programs use digital video mosaic and alignment technology to stitch together video frames. Panorama combines horizontally or vertically oriented frames to produce still images of up to 360 degrees each. Whiteboard accepts horizontal and vertical input to replicate the contents of any flat surface.

Both programs can work with live or previously captured video input. For Panorama, we filmed several indoor and outdoor sequences beforehand with the Sony Digital Handicam DCR-PC7 camera (see sidebar) and a tripod. Then we captured the video into an .AVI file using DPS's Spark Firewire adapter. For Whiteboard, we captured live video using Intel's Smart Video Recorder III, scanning the DCR-PC7 across whiteboards and calendars and inputting the frames in real time.

After the initial input, both programs convert individual frames into multitiled images. After converting the tiles into a finished mosaic, you can adjust image brightness, contrast, or sharpness, or you can crop, resize, or straighten the image. The final image is saved as a .BMP or JPEG file.



TAKE NOTE: *Whiteboard integrates multiple video frames (left) into a single image (right).*

All operations are done very fast. On a Pentium/133, Panorama input an 80-frame video file in 41 seconds, converting the frames to a 360-degree mosaic with a resolution of 3,932-by-348-by-24 bits in 1 minute and 45 seconds. Both programs were very accurate, leaving not a hint of a line or tile pattern that would indicate the image had been stitched together.

Both programs are easy to use, but you should plan on reserving some time to experiment with both capture and filming. When you film a panorama, for example, the camera angle has to be precisely 90 degrees to avoid creating a curved image. With Whiteboard, you optimize quality by keeping the camera equidistant from the board and maintaining the same camera angle throughout the shot; this takes some practice, though.

If either whiteboard or panorama capture is of interest to you, VideoBrush provides an inexpensive and functional mechanism to pursue them.

VideoBrush Panorama and Whiteboard. List prices: $39 (each). Requirements: Pentium/90 PC, Microsoft Windows 95, Super VGA display, 16MB RAM, 10MB disk space. VideoBrush Corp., Princeton, NJ; 888-749-3678, fax: 805-566-0884; www.videobrush.com. *Circle 405 on reader service card.*

Hand-Held Digital Video

If James Bond ever needed a digital video camera, odds are that Q would dream up something like Sony's Digital Handicam DCR-PC7. Sleek, compact, and feature-rich, the DCR-PC7 is just the thing for the secret agent, road warrior, or video enthusiast on the go. Although the $3,199 (list) Sony DCR-PC7 is not cheap, you certainly don't have to be on Her Majesty's secret service to afford one.

The Sony DCR-PC7 is just 5 by 2 by 5 inches (HWD) and weighs 22 ounces. You operate the camera vertically, aiming through either the color viewfinder or the 2.5-inch active-matrix color screen.

The camera is flexible too, offering a 120X digital (10X optical) zoom with image stabilization—critical for small hand-held cameras. The Sony DCR-PC7 captures up to 90 minutes of video in DV format. It is the smallest video camera with a DV output port for transferring video to a computer equipped with a Firewire board. VCR-like playback controls and an on-board speaker let you check your work in the field.

The camera provides S-Video and composite video and stereo audio output. The infolithium-ion battery provides up to 55 minutes of recording time and 50 minutes of playback time; it charges in about 2 hours.

The Sony DCR-PC7 offers auto-exposure modes for high-action, landscape, and dark settings and manual control over white balance and focus. It can also capture over 100,000 still images, functionally replacing a still-image camera.

We tested the camera both indoors and outdoors, capturing video using Intel's Smart Video Recorder III and DPS's Spark Firewire adapter. In general, color fidelity and image detail were quite high, though volume was a constant concern.

The Sony DCR-PD7 reigns supreme in close-up work and convenience. It's one of the few video cameras that can fit into a purse or large pocket. If these are your most important buying considerations (along with DV output), Sony's DCR-PD7 may be the only video camera for you.

Sony Digital Handicam DCR-PC7. List price: $3,199. Sony Electronics Inc., Montvale, New Jersey; 800-472-7669; www.sony.com. *Circle 406 on reader service card.*

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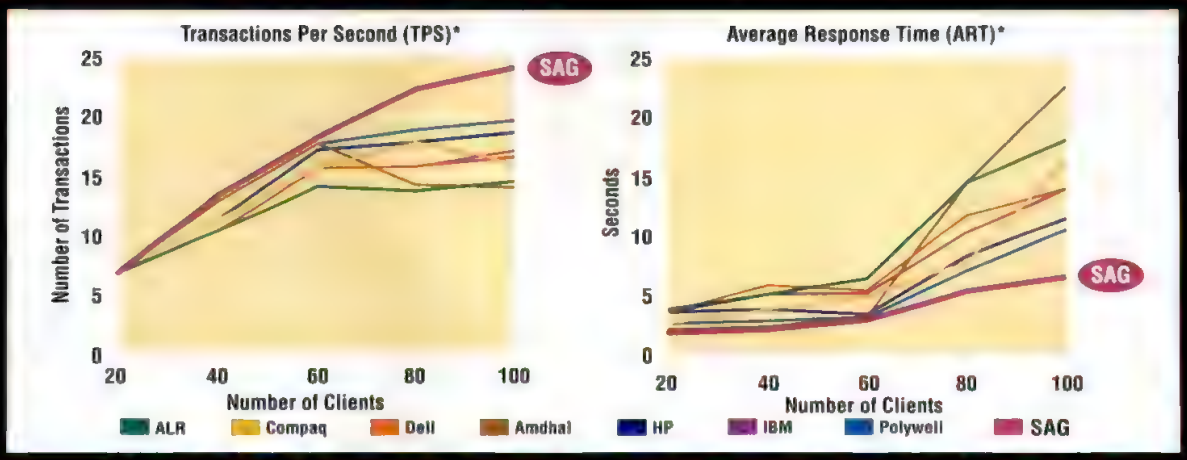

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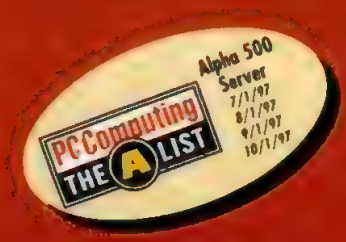

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Second Looks

@HOME NETWORK, MOTOROLA CYBERSURFR

Fast Downloads

When we first looked at cable modems (April 22, 1997), we were blown away by how fast they were. But when we test-drove the @Home Network with a new Motorola CyberSurfr cable modem, we found out just how fast downloading can be.

The @Home Network is a high-speed cable-based Internet service. Coupled with the company's private Internet backbone, it provides amazingly fast Internet access for a very reasonable price of about $40 per month.

@Home is still a very new service, and it is available only in a few cities nationwide. The company is partially owned by five of the nation's largest cable TV operators, including Comcast Cable, Cox Communications, Rogers Cablesystems, Shaw Communications Inc., and Tele-Communications Inc. If you live in an area that is served by one of these cable providers, you will probably be able to get @Home.

@Home uses several different types of cable modems, depending on your local cable TV infrastructure. In our test area in Florida, @Home used the Motorola CyberSurfr cable modem (we originally tested @Home using a LANCity Personal Modem). The CyberSurfr connects to your PC via a 10Base-T Ethernet cable. As part of the $95 installation charge, @Home will install an Ethernet card in your PC if you don't already have one.

Because the @Home service is always on, you need only click your browser or start any standard Winsock-compliant application in order to use it. With its service, @Home provides a customized version of Netscape Navigator (the only officially supported browser).

The only drawback to this service—if this could even be considered a drawback—is that you'll need some time to get used to its blazing speed and permanent connection. @Home combines caching proxy servers and a very high-speed private backbone network to provide performance that approaches—and often surpasses—T1 speeds.

Download speeds range from 4 Mbps down to a crawl, depending on how you're connecting. Upload speeds max out at a mere 768 Kbps. @Home uses a private ATM network to bypass the Internet backbone network as much as possible. In most cases, Web pages simply appear on the screen with no wait at all. But slow and overloaded servers remain slow and overloaded, regardless of your connection speed.

A few of the limitations we found the first time around still exist. Although the CyberSurfr supports multiple IP addressing, @Home assigns only a single, fixed IP address, meaning you can use it with just one PC. Similarly, @Home provides only one mail account, so all members of your household will have to share the same e-mail address. The @Home mail server lies behind a firewall, so you won't be able to access your @Home mail from a dial-up ISP account while you're traveling. Finally, road warriors who want Internet access from the road will still need to subscribe to an ISP, since @Home doesn't offer dial-up service.

Minor pitfalls aside, @Home is undoubtedly a great way to surf the Web.—*Les Freed*

Performance Tests

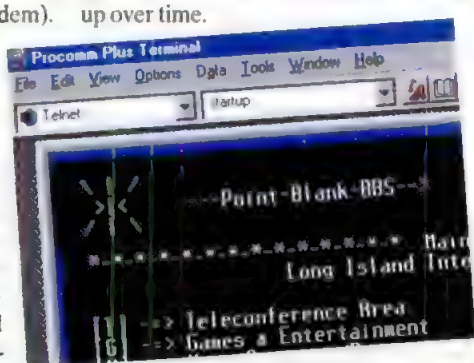
This chart shows the time it took to download a 3.5MB file from Netscape's FTP servers. We ran the test three times with each connection and averaged the results (we did this in the wee hours of the morning, when Netscape's servers are not very busy). The cable modem outperformed a conventional 28.8-Kbps modem by nearly 40:1

▲High scores are best. ▼Low scores are best	Time (min:sec) ▼	Speed (Kbps) ▲
Cable	0:29	976
ISDN 2B	6:11	76
ISDN 1B	8:32	55
28.8-Kbps modem	19:03	25

PROCOMM PLUS

Better Communications

Quarterdeck Corp.'s Procomm Plus 4.0 is the latest Windows 95 version of this popular communications package. When we last looked at the program, we liked many of its features. But as with many programs, problems have cropped up over time.



Quarterdeck has released a 1.7MB software patch that addresses many of these problems. The vendor has also introduced Version 4.5 of the program—Procomm Plus32—which includes all of the 4.01 functionality and adds Windows NT 4.0 support. The 4.01 patch can be downloaded for free from Quarterdeck's site on the Web (*support.quarterdeck.com/patches/pw4uu0001/html*). The upgrade from 4.0 to 4.5 is also free for recent purchasers, but it costs $29 for everyone else.

Unless you need Windows NT support, upgrading your software from 4.0 to 4.01 is a smart idea. The patch will fix a multitude of problems and bugs, with many relating to its built-in mail and new clients. When we first reviewed Procomm Plus, we found its mail program, Internet Mail Client, wasn't complete enough for use as a default e-mail package. The patch does little to change our opinion of the program, since it doesn't add any functionality. But we did notice that the program is now more stable. And more serious bugs that had been misplacing e-mail messages have also been addressed.

Newsgroup users or those who often exchange uuencoded files via e-mail will appreciate the updated attachment handling. Version 4.0 recognized only one message attachment at a time; the new version lets you receive multiple attachments.

Problems that resulted in lost or incomplete faxes have also been resolved. Often when we had done broadcast-faxing, messages would not be sent. This has been repaired, along with FaxWizard and MemoFax issues that caused fax headers or company names to be omitted from messages.—*Karen J. Bannan*

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Praise for HTML, Not Burial

We're forcing HTML to do cruel and unusual things every day. It was never intended to do all those weird tasks on the Web, but like the bumblebee that in theory can't fly, it does them anyway. There's a movement afoot among some Web designers to stamp out HTML—to use WYSIWYG page-design software for everything. The vendors of these programs are squarely behind the movement, of course. They're hoping that you'll never edit another line of HTML. After all, they argue, do you write programs in assembler? Do you tinker with the machine code emitted by your compiler? Do you decompile your application programs and peruse the source code?

This is a noble goal, but HTML is not assembler. It's English, and my 12-year-old can write it. More important, people need to plan their designs to produce editable, extendable sites. I've put some of these products to the test and have spent more time rebuilding old, known-quantity pages with different tools than building new pages lately on my Web site.

My pages at *www.billsbest.com* are hand-coded, although some of them have been updated with page composers. I use HomeSite 2.5a (*www.allaire.com*), doubtless the best HTML editor, but I've been trying to understand the strengths and weaknesses of page-design packages. To date, I've spent the most time with the beta versions of Microsoft's FrontPage 98, NetObjects Fusion, and WebExpress (*www.mvd.com*). These programs work best when you compose sites and pages from scratch. They can import existing sites but tend to butcher working code and introduce problems.

The key to any of these programs is familiarity. Each has its idiosyncrasies. Once you've cranked out a small site, you'll be comfortable enough to get some serious work done. With FrontPage and WebExpress, you have to know some basic things about how HTML pages work—particularly in tables.

FrontPage was the first page-design package, incentive enough for Microsoft to buy the company. FP 98 is an ambitious leap forward from the current version, overcoming most of its inflexibilities. It has two components, the FrontPage Explorer and the Editor. The Explorer does a great job of showing all of your links hierarchically and graphically, but it's not intuitively obvious that you start building a page in the Explorer, which kicks you over to the Editor.

SITE COMPOSERS

I've put page-design packages to the test and now understand their strengths and weaknesses.

Once in the Editor, you build the basic structure for your page or use one of Microsoft's predefined pages as a starting point. If you use some of FP 98's server-side features, make sure in advance that your ISP is willing to support them. The Normal/HTML/Preview tabs flip you among the pseudo-WYSIWYG, source code, and browser views. As in WebExpress, you can't drop an object or start typing just anywhere; you have to build tables that define and constrain the page and its subsections. The table manipulation features are the best you'll find anywhere, with neat tricks such as merging, deleting, or splitting cells. But the HTML editor, which you theoretically never need, is pathetic.

WebExpress doesn't even have an HTML editor, but it will use any editor you designate. HomeSite is a perfect match for it: They're both shareware. Table manipulation tools are minimal, and WebExpress, like other generators, relies on percentage widths instead of pixel values. I like the absolutes of pixels because they give you maximum control over how the page looks on anything from a laptop to a 20-inch monitor. You can override the percentages with pixels, but it's tedious. WebExpress generates neat, readable HTML.

NetObjects Fusion takes a radically different approach to building a page. You can drop a graphic anywhere on its grid—or open a text box and start typing without giving a moment's thought to tables or other arcana. A properties worksheet next to your composition grid changes according to what you've clicked on and what kind of object you're creating. But this flexibility comes at a price: Heaven help you if you need to edit the HTML the program emits. It generates tables but also makes generous use of dotclears—an HTML trick of inserting invisible graphical elements to push things into place. It works, but the code is inscrutable.

These packages are full of promise, but they're not magic. If you truly want to understand Web design, grab a copy of HomeSite, a collection of Web graphics (such as deMorgan's WebSpice, *www.demorgan.com*), or Corel's Web Gallery and get to work. PC

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JOHN C. DVORAK

DVD's New Spin

The road to DVD has been marked by chuckholes and detours, beginning with the adoption of DVD standards and going through squabbles and name changes of the system itself. Just added to the mix is the peculiar new Divx feature, which will be available in 1998 and will let you play a one-time-use DVD disk.

Divx means Digital Video Express. It was developed by an R & D firm owned by Circuit City, and the idea came from—again, this is weird—the world's most important entertainment law firm, Ziffren, Brittenham, Branca & Fischer. It's a long story, but suffice to say the invention of Divx is more than a little important. Already Disney, DreamWorks, Panasonic, Paramount, Universal, ZDS, and a few others have vowed to back the new system.

DIVX

It's a long story, but suffice to say the invention of Divx is more than a little important.

Divx is a circuit and a system within the DVD player itself that permits consumers a two-day movie rental, regardless of the date the disk was purchased. What it really amounts to is a self-destructing disk. Additional rental periods can be purchased over a modem line connected to the DVD player. The modem connection to your phone line is a key element, although it connects only once every few weeks for billing purposes. The special disks, which can be played only on Divx-enabled DVD players, are expected in 1998 and should sell for $4.99. It's kind of pay-per-view gone mad.

Though some creativity is behind this idea, you really have to wonder how many days will go by before this system is cracked by hackers. And, yes, I use the word *days*. There is data on this disk, and it can be hacked out. The honchos behind this device think this will be harder than I think it will be. The encrypted communication over the modem between the player and Divx Central seems to be the key to success. We'll see.

No matter. All the copy protection is there mainly to assuage the fears of the paranoid studio executives, who think that everyone wants to copy their movies. They may also see a bonanza from this system. I can understand why a retailer such as Circuit City would love this product. It turns retailers into rental outlets without the hassle of restocking returned tapes. The sales pitch to the consumer includes the proclamation: "There are no late fees!" In fact, if these disks can be sold for $2 or so, it will decimate the rental business. This is assuming the whole world turns to DVD—a big assumption since nobody is flocking to it, and those who buy DVD today do not have hardware that is Divx-ready.

At this point, the Divx system seems somewhat dubious as a consumer electronics product, since there are so few DVD players on the market. But how about using the same technology as a software distribution system for the shareware of the future? Or even more interesting, the establishment of true rentware based on the reuse technology developed for viewing the movie again?

I can see huge libraries of emergency-use DVD programs, for example. CorelDraw is not necessarily a program that users of Adobe products have on hand (and vice versa). But a situation may occur in which a user needs to use CorelDraw for a couple of weeks for a special project; thus, a rental is perfect. A large corporation could keep on hand a library of all its major software without worrying about cost or piracy. When people needed something, they could rent it. The possibility exists that software rental, done correctly, could have a profound and positive effect on profits.

The roadblock to software rentals has always been the "whom are they kidding?" aspect of the rental agencies. Everyone knows that software rentals have been a "wink-wink, nudge-nudge" scam, letting people copy the software and freely use it. But the concept of legitimate software rentals is a good one, even though so far there has been no good mechanism through which to implement the concept. But except for my fear that this system will be cracked, it seems like the best solution I've yet seen.

Generally, the Divx scheme appears sound. CDs and CD-ROMs cost 35 cents each to stamp out, and DVDs will eventually be priced likewise. It costs more than that to restock a returned videotape, so the economics should work. And between 35 cents and the retail price, there is plenty of room to make money.

The only possible dark side might be that the public would eventually realize that disks are cheap to produce and sell and that they (the people) have been getting ripped off for years. A small price to pay for progress, eh?

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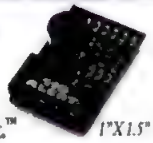

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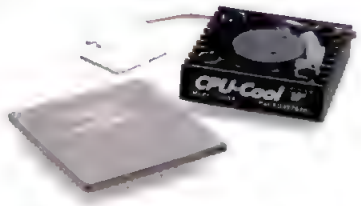

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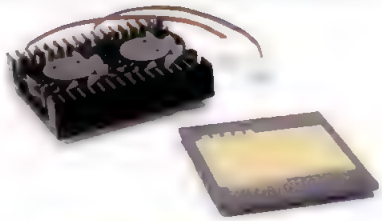

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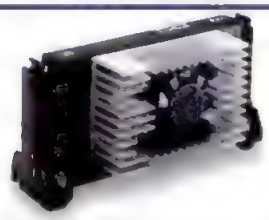

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JOHN C. DVORAK

Inside Track

There are strong rumors in the Valley that Intel is planning to add new instructions to the MMX instruction set. Since MMX has been in the field for a while, the need for additional instructions is becoming more apparent. Also, Intel is serious about putting more 3-D functionality on the chip itself. The problem here is marketing. Or so it seems. I can't believe that after what Intel went through to move the public to MMX in the first place, it's willing to risk a fiasco by immediately making obsolete yet another generation of computers.

I can't believe that after what Intel went through to move the public to MMX in the first place, it's willing to risk a fiasco by immediately making obsolete yet another generation of computers.

But **recent revelations** point to Intel's ability to upgrade the processor microcode on the fly with a special encrypted system. Is it possible that by using this upgrade technology Intel can **add** the new MMX instructions **after the fact?** Imagine this from the **marketing side.** You bring out MMX chips and move all users to MMX. Your competitors—AMD and Cyrix—add MMX to their chips and play along. You let everyone get used to MMX and make sure that AMD and Cyrix are fully ramped. Then you **pull the rug out** from under everyone with additional (and important) MMX instructions. Gee, guess what? Those of you who bought the Intel chips can make the upgrade now (possibly at no cost) with a simple download. And you **poor suckers** who bought a competitor's product—well, better luck next time. Ha ha!

This potential scenario explains a couple of odd events. First, the field upgradability of the new Pentium chips was **kept a secret** well past the introduction of the chip. Only when a new bug was discovered was Intel's ability to upgrade the chip on the fly revealed. Suddenly this upgrade "feature" is a godsend that will fix flaws; at least, this is what seemed reasonable to say at the time. But what if this feature was **never meant to fix flaws?** I was always baffled that Intel took so long to give us the news regarding this feature, even after the bug was discovered. I've concluded it was because **all future chips will have bugs** that need fixing, and this is the cheapest solution. But no company believes that its final product will have bugs. This field-upgrade feature would be a virtual admission of guilt. And if such a feature were in the chip, don't you think the company would **leverage** it in the market with promotion? So what would be a better use for such a technology, and why would you want to keep it a secret? To **ambush the competition,** it seems to me. Amazing if true.

Better TV than Ever Dept.: Finally, after years and years, it seems that people are seriously using their computers as functional TV sets, utilizing the various TV tuner/cards on the market. In fact, ATi has added a tuner to one of its display cards. But most TV pictures do not take full advantage of the high resolution of the monitors. Enter Yves Faroudja, **the genius** behind a variety of video inventions. A few years ago he showed the National Association of Broadcasters something called Super NTSC, a cheap modification that did line doubling and improved the NTSC signal to the point where it mimicked analog HDTV. This was during the peak of the HDTV hype. But **none of this went anywhere,** and Faroudja was content to license Hi-8 and 6-mm digital camcorder circuits to the likes of Sony. Well, I still remember seeing what this circuit accomplished, and I've never forgotten it. It's stunning. So, finally, Faroudja **licenses the design to S3** so it can be used on progressive-scan monitors. Expect to see some incredibly sharp TV on your computer soon! We should see some sort of product by the first quarter of 1998. But let me tell you, a **smart cookie** could do worse than grab the eventual S3 chip and make a box for regular TVs.

More TV News Dept.: Many *PC Magazine* staffers are quite impressed with the newest version of WebTV. Another device recently announced is the Divx DVD player, which plays rented disks that "self-destruct" after 48 hours and don't need to be returned. These products fit in with yet other products that all have **something in common:** They hook up to a phone line. Even new computers, such as the Toshiba Infinia, require a phone line hookup for upgrades. There seems to be a **mad rush** to hook everything to a phone line. I have to wonder where will it end, and how will we manage to hook device after device to the phone line? How many phone lines must we have? Obviously more than one.

I don't want to be the last guy to point out a simple fact. But any upgrade to the phone system switches can **instantly double or triple** the number of lines into our homes without any rewiring. ISDN uses two wires, just like a standard line, but delivers two phone numbers and adds a signaling channel, too. Both of these discrete lines are capable of 64 kilobits, which can easily be multiplexed into two or more voice channels.

A single 64-Kbps channel should be able to handle WebTV, Divx, normal Web surfing, and other chores. With ADSL, which supposedly doesn't even require that the phone company replace its switches, you get 1.544 Mbps over two wires. This is T1 speed, which can handle an office full of phones plus all sorts of digital activity. None of this is ever going to be done without a **government mandate.** Just a thought. Gore, are you listening? PC

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JIM SEYMOUR

Tips for...umm...Your Friends

So how do you like being a support tech? Helping people find lost files, getting printers working, explaining the mysteries of ZIP files, and trying to fix bungled registries. Not exactly what you had in mind when you started down this path of becoming a PC expert, was it?

At least you're in good company. Because turning into a de facto technical-support person once you become knowledgeable about PCs is something that happens to us all. We wind up as the Designated Technical Support Providers for our husbands, wives, coworkers, neighbors, uncles, sisters, bowling team, beach volleyball partners, and more. (But not your kids, of course; they can run circles around you when it comes to explaining arcane corners of the Windows UI. They're *your* DTSPs.)

A confession: I love it.

I love the schizy moving from a three-day corporate retreat, where we battled 12 hours a day over a three-year, $100-million-technology strategic plan, to helping my brother-in-law escape from DriveSpace gone berserk or helping my wife get that new tape backup drive installed.

And whether you're ready to admit it or not, I'll bet you do, too.

The satisfaction of helping those close to you with a task they find baffling far outweighs the frustration of showing them how to create a folder for the tenth time. And if your work has to do with computers and software, this informal need-your-support network that has grown up around you is a huge advantage, because it reminds you what it's like not to know how to do these things.

Over the years, I've come up with a short list of the most important tips that I give friends who turn to me for help. Many of these are perfectly obvious to the cognoscenti, but precisely because they *are* so obvious to us, we fail to pass them on to those for whom PCs are still mysteries. I think you'll find these Big Ten Tips handy for your friends, too—and maybe even for yourself.

PERSONAL TOUCH

It's satisfying to help someone with a task they find baffling.

1. Separate programs and data on your hard disk. Never mix program files together with your documents, worksheets, drawings, databases, and so forth, on your PC's hard disk. Instead, create one or more directories—say, by project, topic, or year—and save all your data there. That makes it much easier to find your files, as well as quicker to back up data files, since you're not making copies of all those programs as well. They're unnecessary, since (in case of a crash) you could easily reinstall them from their original CDs and floppy disks.

2. Use lots of directories to organize your data files. I've spent literally weeks of my life sitting at the elbows of friends, relatives, and clients, searching their hard disks for files they "just know are here *somewhere!*" Far too many users dump everything in Windows' infamous My Documents folder, just as a few years ago far too many users dumped everything in their C:\ directories. And use subfolders under your primary folders, too. For that program you agreed to design for the ballet, don't create just a folder titled Ballet Program, but under it create Artwork, Text, and Ads for storing all of the related files. Keeping your work sorted into logical clumps makes it easier to find a month or a year later.

3. Use Windows 95's Long Filenames feature. For years we bitched about having to use the eight-dot-three filename scheme of DOS and the inscrutable filenames that resulted: FENZXDRK.DOC, NUETBUDG.XLS, DGRNGSL7.DBF. So Windows 95 comes along with filenames up to 255 characters and what do we use? FenZxDrk.doc, NuFoBudg.xls, and DGrNSls7.dbf. You don't have to use all 255 characters that Windows allows, but why not something you'll be able to decipher next week, such as Fenwall Zero Budget Draft-Ken.doc, New Employee Transfers Budget.xls, or Deutsche Grammophon Recordings List 1997.dbf?

4. Lose Windows' FileFind. Forget about Windows' built-in file finder. When you need to excavate a file you know is buried *somewhere*—and all you can remember is some key words in that file, not its filename—you need something better. Use a program like PowerHunter, which you can download from *www.zdnet.com*. PowerHunter indexes your data files, automatically updates the indexes, and then helps you to find files in that indexed universe *fast*.

5. Check for new video drivers. It's so easy to check vendors' Web sites for new drivers that there's just no excuse for putting up with poor display performance, which in my

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experience is caused by driver problems at least 75 percent of the time. Video problems are among the nastiest ones to solve; you can avoid having to walk down that dark road simply by installing an up-to-date driver for your video card.

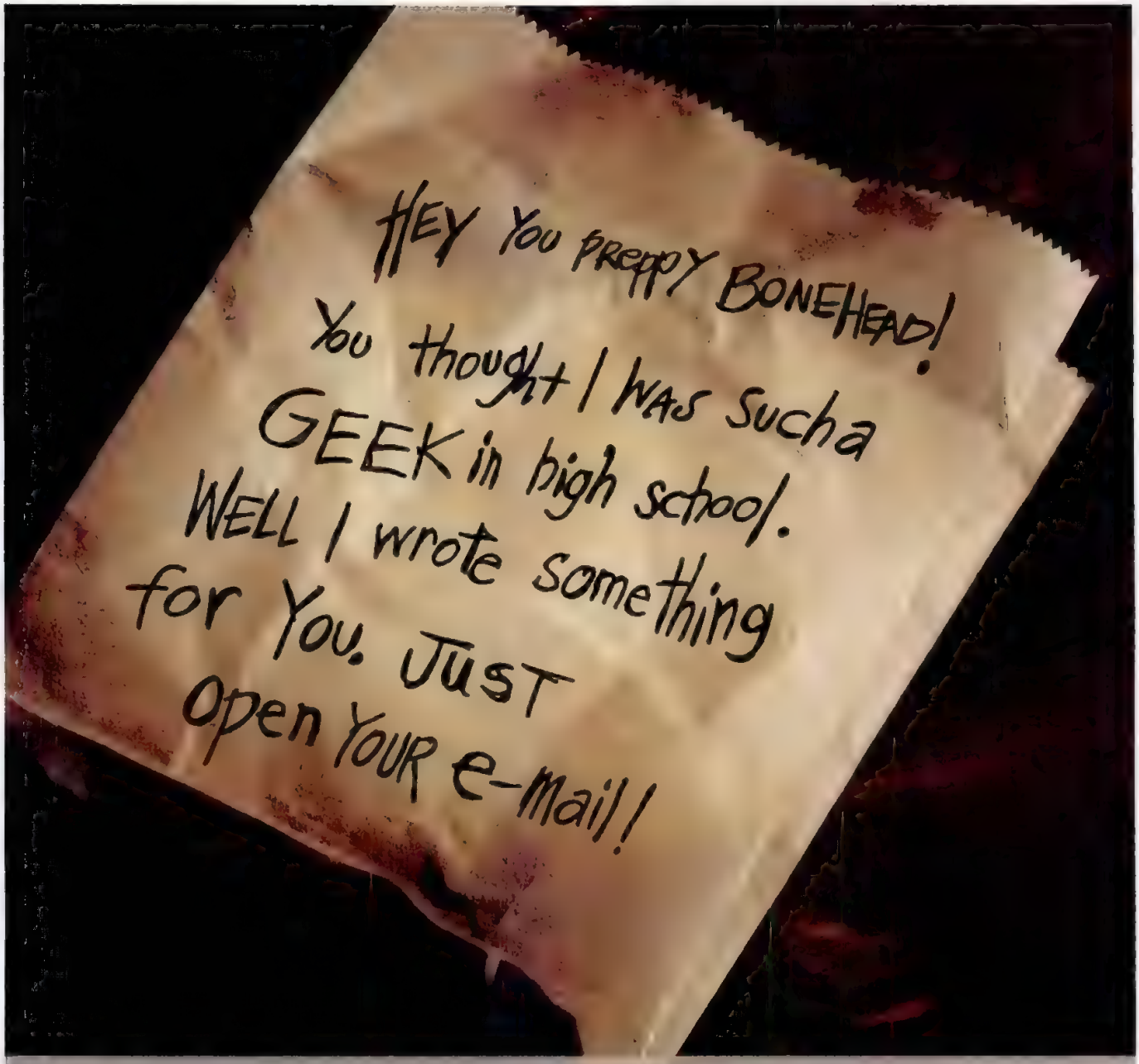
6. Check for new printer drivers. Ditto.

7. Get old, unused programs and fonts off your hard disk. They waste space, clutter the registry file, and reduce performance. But don't just start erasing .EXE files willy-nilly; use an uninstall package like Quarterdeck's CleanSweep, my favorite among several good products in this category. These programs work best when they're uninstalling programs added to the PC *after* the uninstall was put on the disk, so go buy and set up the uninstall package *now*.

8. Run Scan and Defrag routines frequently. As Windows stores files on your hard disk, it spreads them all over the place. Soon, opening a file sends the disk's read/write heads racing back and forth across the disk, slowing performance. The slow, feeble Scan and Defrag routines that come with Windows 95 are better than nothing, though it's worth the money to pick up a serious disk-maintenance package such as Norton Utilities or Nuts & Bolts. But neither helps unless you *use* it; run a Scan every week and a Defrag every month and you'll avoid a lot of problems—maybe even catastrophic data loss.

9. Check the Web frequently for product upgrades and add-ons. Now that access to the Web is essentially universal, most software and hardware makers have gotten pretty good about posting frequent bug fixes, minor updates, and new add-ons to their Web sites. It's crazy not to take advantage of these free improvements in the products you already own. You absolutely want to keep your PC's BIOS at the latest level, both to add features (support for big EIDE drivers or better power management, for example) and to clean up bugs. Similarly, patches and upgrades from software vendors can help you to avoid problems—and often to get much of the functionality that's coming someday in the next major release.

10. Make an emergency disk, then keep it handy and up to date. Disk utility packages will produce a floppy boot disk, which can be absolutely essential if—*when*—your PC goes down. But hardly anyone makes such disks. Or if they do, they don't keep remaking the disks at regular intervals to keep up to date. Or they make them and then lose them. You can do a lot to calm the panic attack when your PC crashes if you make that emergency disk *today*. PC



All over the world nerds are getting their revenge. By writing computer viruses that get into your computer and do things like destroy your files or corrupt your operating system.

Worldwide, more people use VirusScan than all other anti-virus products combined. Source: IDC 1995

These viruses enter your computer over the internet, through email, or even by sharing computer games.

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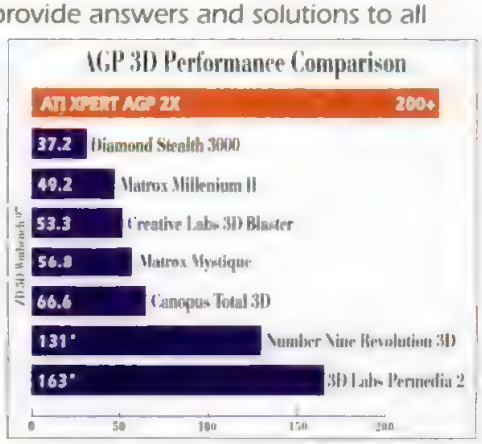

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BILL HOWARD

Whatever Happened to Ease of Use?

It was one of those chance encounters between two businessmen on the same flight. The divisional chief for a top notebook PC vendor noticed a fellow passenger using one of his company's notebooks. They struck up a conversation. The user mentioned one of his top frustrations: Starting up or closing down the notebook took 2 or 3 minutes.

How could that be, wondered the computer exec. It wasn't for lack of power-down options. In addition to a cold shutdown, his company's notebooks had two forms of suspend and resume, plus screen blanking, plus hard disk spin-down, plus variable CPU speeds—all of the settings user-configurable. Suspend took at most 30 seconds; ditto for resume. You could implement suspend by closing the lid, pressing a button, or leaving the computer for several minutes of inactivity.

The answer: Suspend and resume were so confusing to users at the company that the IS department, on receiving new notebooks, wiped the disks clean, then installed a generic Windows 95 operating system with no power conservation. Although savvy users realized that they were being shafted by IS, the number of support calls went down because other users were no longer "confused" by suspend and resume.

Examples such as this show how far we are from true usability or ease of use. Vendors think they're addressing usability issues. They spend considerable time and money on the problem. They run focus groups, and many have costly usability labs. But user (and IS) behavior shows that vendors are not solving the problem.

If you use a notebook, do you know what all the special keys do—usually the Fn key combined with F1 through F12? If there are glowing indicator diodes that show the state of your computer (Caps Lock, AC versus battery power), do you know what they do? And do you know the meaning of the tiny icons next to them? (The ones that look like circles with V's or lazy Z's in them?) My current notebook has one icon, a rounded-corner square with a double-headed arrow pointing up and down. On a desktop monitor, I know that this represents the vertical sizing control. On my notebook, I discovered that it's Scroll Lock. Can you even make out the tiny icons when they're beige moldings on beige cases, or worse, black moldings on black? Most users can't.

ULTIMATE DESIGN

User behavior shows that vendors are not solving usability problems.

What's to blame? I see three culprits, and they're all related.

First, vendors don't listen to real users. There's knowledge to be learned in a usability lab, but there's also wisdom to be gained by listening to real people in real situations. Our computer exec wouldn't have been surprised to find that people were rejecting his company's power-saving utilities.

Second, users are too hung up on the initial purchase price of hardware. That leads vendors to shave costs in areas that annoy the same users who are demanding cheaper hardware. For instance, applying a coat of contrasting color to the molded icons would add only a fraction of a dollar to a notebook's price. But vendors don't do it because—to paraphrase erstwhile Senator Everett Dirksen—a dollar here, a dollar there, sooner or later it adds up to real money.

Third, vendors are so concerned about being good citizens of the world, favoring no one country, that they've moved from plain-English labels on their hardware to universal icons. Now the controls on the hardware are equally incomprehensible in every country of the world.

Here's what's ironic: At a time when direct PC vendors can customize the hardware in every single PC they sell—"Can we have one built for you?"—the same makers of hardware and peripherals appear incapable of customizing cases and documentation even on a country-by-country basis. How hard would it be to have a high-quality, stick-on overlay that defines the controls using not icons but plain English, plain French, plain German, plain Spanish, and other languages?

For starters, here's one suggestion for notebook vendors: Build in the modems. Users hate external modems. If some country is too small to justify certifying an internal modem to the satisfaction of its telephone bureaucracy, okay, fall back to the PC Card modem and its infernal proprietary connector cable. But if so, do us a favor and mark one side of the connector cable "Up" so that users don't force the connectors in upside down. And please, no icon substitutes for "Up." PC

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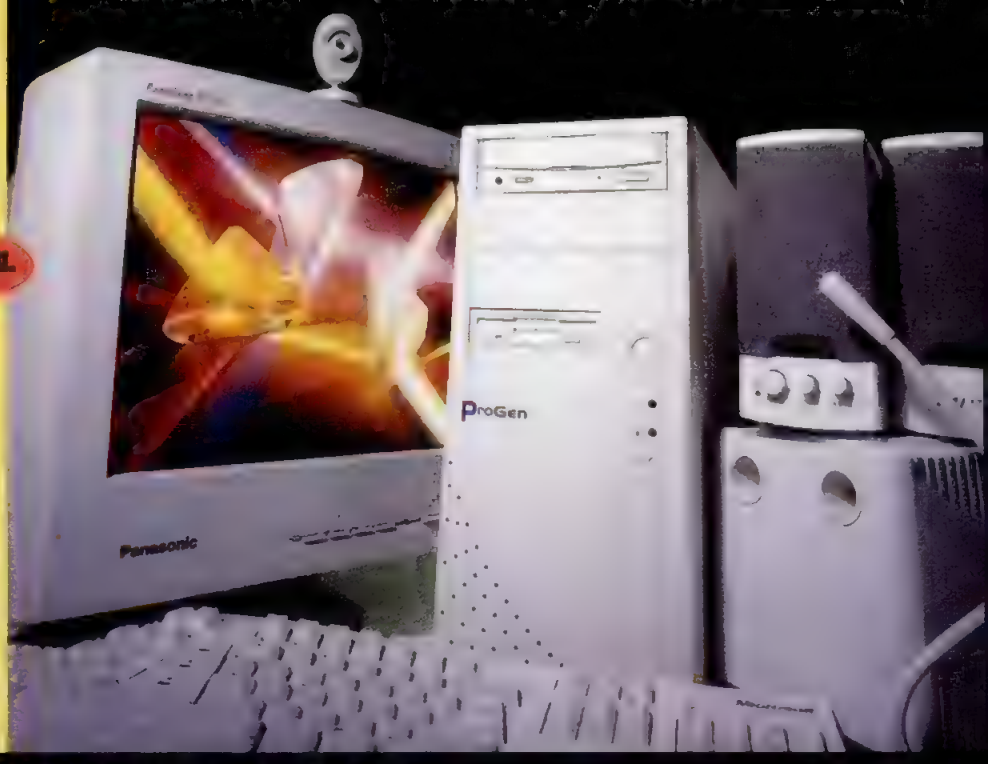

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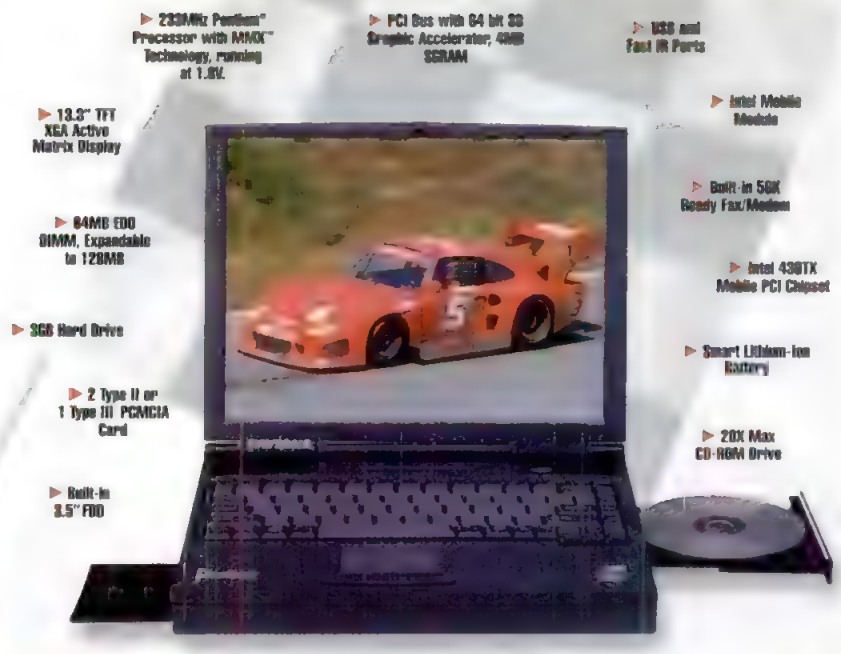

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Cover Story

FACE

These new browsers are now Internet suites, delivering tools for all your online tasks.

By John Clyman

BROWSERS HAVE ALWAYS BEEN fast-evolving products, but the latest generation takes an unprecedented leap forward in HTML support, feature set, and user interface. No longer merely a simple viewer that lets you navigate among static Web pages, the browser has become the centerpiece in a suite of Internet client applications that offer increasingly rich tools for communicating, sharing information, and experiencing interactive content.

First, the easy question: Should you upgrade to a fourth-generation Internet suite? In a word, yes. Both Microsoft Internet Explorer 4.0 and Netscape Communicator 4.0 are dramatic improvements over their predecessors, though their browsers often lack the stability and polish we've come to expect from mainstream productivity applications.

The harder question: Which suite is right for you? With IE4 available free and Netscape's products freely downloadable (they're priced from $39 for the standalone

INTERNET EXPLORER 4.

-OFF

Navigator to $79 for Communicator Pro), we suspect many power users will keep both browsers on their systems, even if they don't run them simultaneously. Given the two companies' history of staggered browser releases, you may want to use whichever is more recent to take advantage of the improvements it introduces.

Nevertheless, we put the two companies' Internet suites head-to-head and evaluated their support for browsing, mail, security, authoring, collaboration, and push content. Our comparisons focused on the features available to users with 32-bit Microsoft Windows machines.

We found that IE4 offers the richest browsing experience, even without its optional desktop integration, about which we have decidedly mixed opinions.

COMING TOGETHER

IE4 and Communicator have converged in many areas: Both incorporate NNTP newsreaders and POP3- and IMAP4-compliant, HTML-aware e-mail clients; rudimentary Web-page editors; push delivery systems; and various live-collaboration tools. (Lightweight installations that omit many of these components are available.)

Both have vastly improved interfaces with flexible toolbars, extensive drag-and-drop support, automatic URL completion, and richer control over attributes such as security. Both support automatic software updates, a welcome addition for

O VS. COMMUNICATOR

ILLUSTRATION BY JOE SKIVSUAL LOGIC

Why You Should Upgrade

	MICROSOFT INTERNET EXPLORER 4.0	NETSCAPE COMMUNICATOR 4.0
Browser	IE4's convenient new Search and Favorites Explorer bars, as well as its right-click control over bookmarks and toolbars, make it an essential upgrade for all Internet Explorer users.	Navigator 4.0's drag-and-drop toolbar, complete history list, dramatically increased stability, and better download feature make it an upgrade that every user should have.
Push/Off-line browser/Web desktop	With its channels and its Web-everywhere interface, IE4 doesn't just offer you the Web. It gives you the option of merging the Web with the operating system.	Channels are big news for home and corporate users alike, so Netcaster alone is reason enough to upgrade from Version 3.0. Without it, you'll miss out.
Mail and news	Everything from the integrated three-pane interface to multiple e-mail accounts to more sophisticated in-box rule options makes upgrading to Outlook Express a no-brainer.	Although it wouldn't be hard to improve on Netscape's previous e-mail and news clients, Messenger adds an improved interface, built-in HTML authoring, and support for IMAP4 and LDAP protocols.
HTML authoring	FrontPage Express, despite its limitations, is an effective and powerful beginner-level tool for creating Web pages.	Composer adds improved text-formatting and table-development tools without forcing users to learn a new interface.
Collaboration	NetMeeting 2.0 is noteworthy for its videoconferencing capabilities and complete support for better interoperability.	Upgrade from CoolTalk to Conference for voice mail and high-bandwidth H.323 support. Consider Calendar for personal or group scheduling.
Dynamic HTML	Version 4.0 supports Web pages that are richer and more alive than anything you can get anywhere else.	Communicator supports Cascading Style Sheets and other features that will become ubiquitous on the Web before long.
Java	IE4's Java implementation is more secure and faster than ever; it's the best Java environment on Windows.	Communicator's Java finally performs acceptably, and with reasonable stability.
Security	IE4's Security Zones make it easy to divide Web sites up into those you trust, those of which you're wary, and those you totally distrust.	Communicator's certificate management gives you more fine-grained control and lets you decide just who should be trusted with your computer and who should not.

products that go through incremental version updates and security patches.

On the HTML front, both browsers support basic level 1 Cascading Style Sheets (CSS). More important, each implements dynamic HTML (DHTML), a dramatic advance that lets Web designers create pages that change in appearance on the fly. With DHTML, Web pages begin to mimic the interface richness of traditional applications. Unfortunately, Netscape's and Microsoft's DHTML models are almost entirely incompatible, and the World Wide Web Consortium has not settled on a formal standard. Few Webmasters are likely to implement DHTML extensively until a standard is established.

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Check in regularly at PC Magazine Online to get the latest Internet suite news and updates, and don't miss ZDNet's Browser-User, your one-stop source for browser information.

VIVE LA DIFFÉRENCE

Despite similarities in their products, the two companies are taking different paths in their attempts to dominate the browser market. With IE4, Microsoft has effectively merged the Web browser and the operating system. An integral component of the Windows shell, IE4 is now the browser for both local and Web content.

The traditional desktop wallpaper turns into an "active desktop" that can host miniature Web pages, and Internet-related tasks mesh with the Start menu. These shell integration features will be the most prominent change in Windows 98, scheduled to ship next May. (For details, see "Memphis & IE 4.0," September 9, 1997.)

In Netscape's vision, the browser suite is not simply a tool for navigating the Web but the client side of an enterprise-wide, cross-platform architecture for exchanging information both within a company and outside it. Communicator Pro, the most extensive version of the product, even includes a group-calendar application and a Java-based terminal emulator.

Netscape leads Microsoft in cross-platform support, shipping products for 15 platforms, while IE4 is currently available only for Windows 95 and Windows NT. With this strategy, Netscape is going after groupware giants IBM/Lotus, Novell, and, of course, Microsoft.

Read on for our component-by-component assessment of the two suites, and decide which approach suits you better.

BROWSERS

The fourth-generation browsers from Microsoft and Netscape can display Web pages faster than their predecessors, both have overhauled interfaces with a multitude of functions accessible with a mouse click, and both offer improved keyboard

Our Contributors JOHN CLYMAN is the senior online editor of *PC Magazine*. EDWARD MENDELSON and JAN OZER are contributing editors of, and JOHN GARRIS and NEIL RANDALL are frequent contributors to *PC Magazine*. LARRY SELTZER is a technical director at PC Magazine Online. JAY MUNRO was the project leader, and DAVID LIDSKY was the associate editor in charge of this story.

shortcuts for expert users. Netscape's and Microsoft's third-generation browsers were roughly matched in convenience and speed, but with version 4.0, Internet Explorer roars decisively ahead in convenience, customizability, and performance.

The most important thing about a browser is its ability to render pages. In our informal survey we saw impressively fast page rendering in both browsers, with IE4 generally a bit faster than Navigator, but we still found massive inconsistencies in the way the two handle JavaScript, with some pages successfully displayed only in Navigator and others only in IE4, with no clear real-world winner. IE4 shows uneven performance in downloading files from the Web, a task at which Navigator excels.

Both browsers offer improved control over typeface and size, an important feature. Netscape supports Bitstream's TrueDoc font technology, for example, while only Microsoft supports a forthcoming W3C font-embedding technology. Both browsers display the same type sizes by default. Navigator lets you change the default type sizes from a preferences menu. IE4 has a menu item and an optional toolbar button that let you choose larger and smaller fonts, but it doesn't let you specify an exact point size.

Because browsers have evolved into full-scale Internet suites, integration features are important. IE4 lets you choose which e-mail or news reader will open when you click on a mail or news link; you're not locked into Outlook Express. Navigator only opens Netscape's Messenger mail and news reader, even if you specify another mail or news program as the default everywhere else in Windows.

Navigator has a top-line menu and a floating toolbar that let you easily access Messenger, Composer, and Collabra. IE4 lets you open whichever programs you chose as the default mail client, news reader, or HTML editor, either from IE4's toolbar or from a miniature toolbar

Editors' Choice

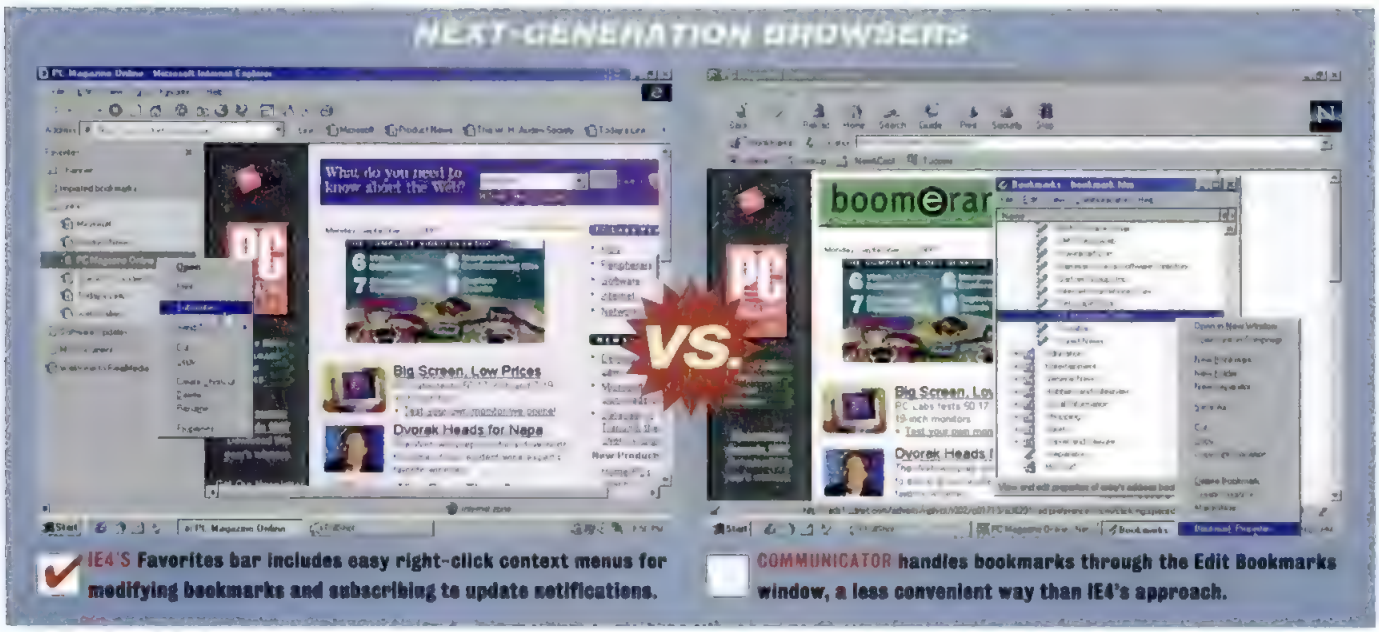
• Microsoft Internet Explorer 4.0

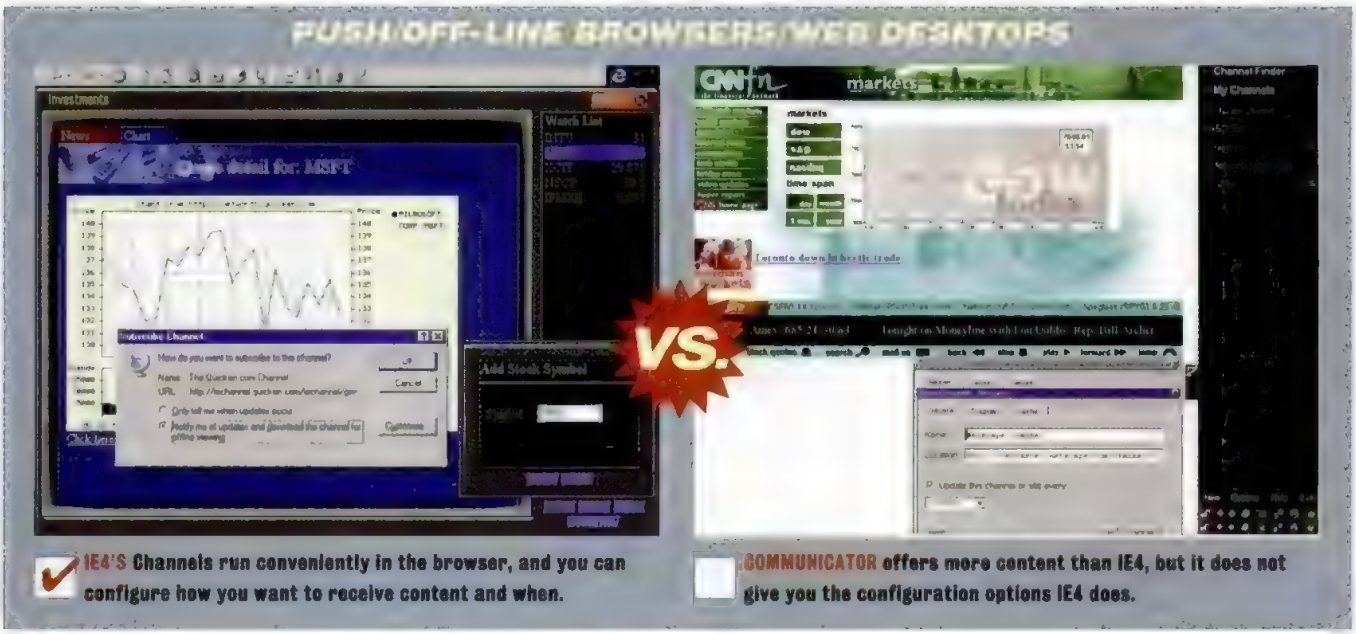
PC MAGAZINE EDITORS' CHOICE

Both browsers offer significant enhancements over their 3.0 incarnations of a year ago, so many users will probably want to run both if they can. But Microsoft Internet Explorer 4.0 surpasses Netscape Communicator in functionality and ease of use, and we award it our Editors' Choice.

IE4 has taken its strengths from the 3.0 generation—a highly customizable interface, great navigation features, a very fast Java virtual machine, and excellent standards support—and extended its dominance in these areas. Users have a great measure of control over everything from where their toolbars go to how they view mail and news. New Explorer bars let you navigate through your Favorites, History, search results, and push channels with ease and elegance. IE4 is still the fastest Windows Java environment and an excellent platform for serious Java development. Microsoft's support for style sheets in IE3 has led to an impressive model for creating dynamic HTML.

Communicator improves significantly on Navigator 3, delivering a slicker interface, better performance (particularly for Java), better stability, and in Messenger, a vastly improved mail client. Netscape just did not offer enough enhancements to its product compared with the improvements Microsoft has made in IE4. Of course, if you don't have 32-bit Windows, Communicator is the only new option at the moment—and still a good one.



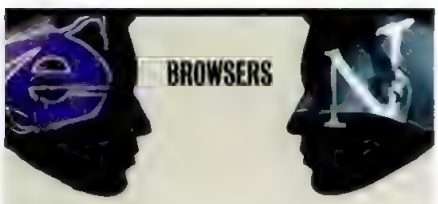


✔ **IE4'S Channels run conveniently in the browser, and you can configure how you want to receive content and when.**

COMMUNICATOR offers more content than IE4, but it does not give you the configuration options IE4 does.

that appears on the Windows taskbar if you use IE4's desktop integration feature.

Both browsers have enhanced interfaces, but IE4 has gone further, offering a slick, customizable browser. Navigator's interface enhancements give it a feel more like IE3. IE4, when run as a standalone browser without the new desktop integration option, looks at first glance like IE3 with a few new toolbar buttons. When you look closely, though, you'll find massive usability improvements.



Excellent	**Page rendering**	Excellent
Excellent	**Search tools**	Good
Fair	**File uploading and downloading**	Excellent
Excellent	**Customizable toolbars**	Good
Excellent	**Keyboard-only interface**	Good
Excellent	**Right-mouse-click support**	Good
Excellent	**Bookmarks**	Good
Excellent	**Font support**	Good
Excellent	**Multimedia support**	Good
Good	**JavaScript support**	Good

We rate each feature for power and ease of use. We consider whether each product has a particular feature and compare its implementation with that of the competitor and any third-party tools that may provide the same functionality.

Most significant is the new Explorer bar feature, a pane in the left panel of the browser that can display compact lists of search results, Favorites (Microsoft's name for bookmarks), recently visited sites, or subscribed Channels. Navigator's bookmark feature offers only an awkward subset of these useful navigation aids.

IE4's Search bar offers popular search engines and displays search results in the bar while using the main browser window to display the returns you choose. Netscape's toolbar search button sends you to its Netcenter Web site to choose from the search engines available there.

IE4's Favorites bar makes your bookmarks more accessible. Navigator lets you access bookmarks from a toolbar or a drop-down menu, but if you want to keep them open while you surf, you have to open a separate Edit Bookmarks window. IE4's Favorites bar, also accessible from the main menu, lets you right-click bookmarks to rename, delete, or schedule them for update notification at regular or custom intervals. While Navigator lets you add and file bookmarks using drag-and-drop, you have to open Edit Bookmarks to modify or remove items from the bookmark list and toolbar.

Navigator's toolbars can be moved, opened and closed, but not combined as in IE4. Navigator's Personal Toolbar awkwardly uses fixed-width buttons, unlike IE4's buttons, which match the length of the text displayed on them.

Web-page printing, historically a major annoyance, is improved in IE4, which lets you print all the frames displayed in the browser or just the current frame, and lets you print out a text list of links from the current page. The latest Navigator offers no printing enhancements.

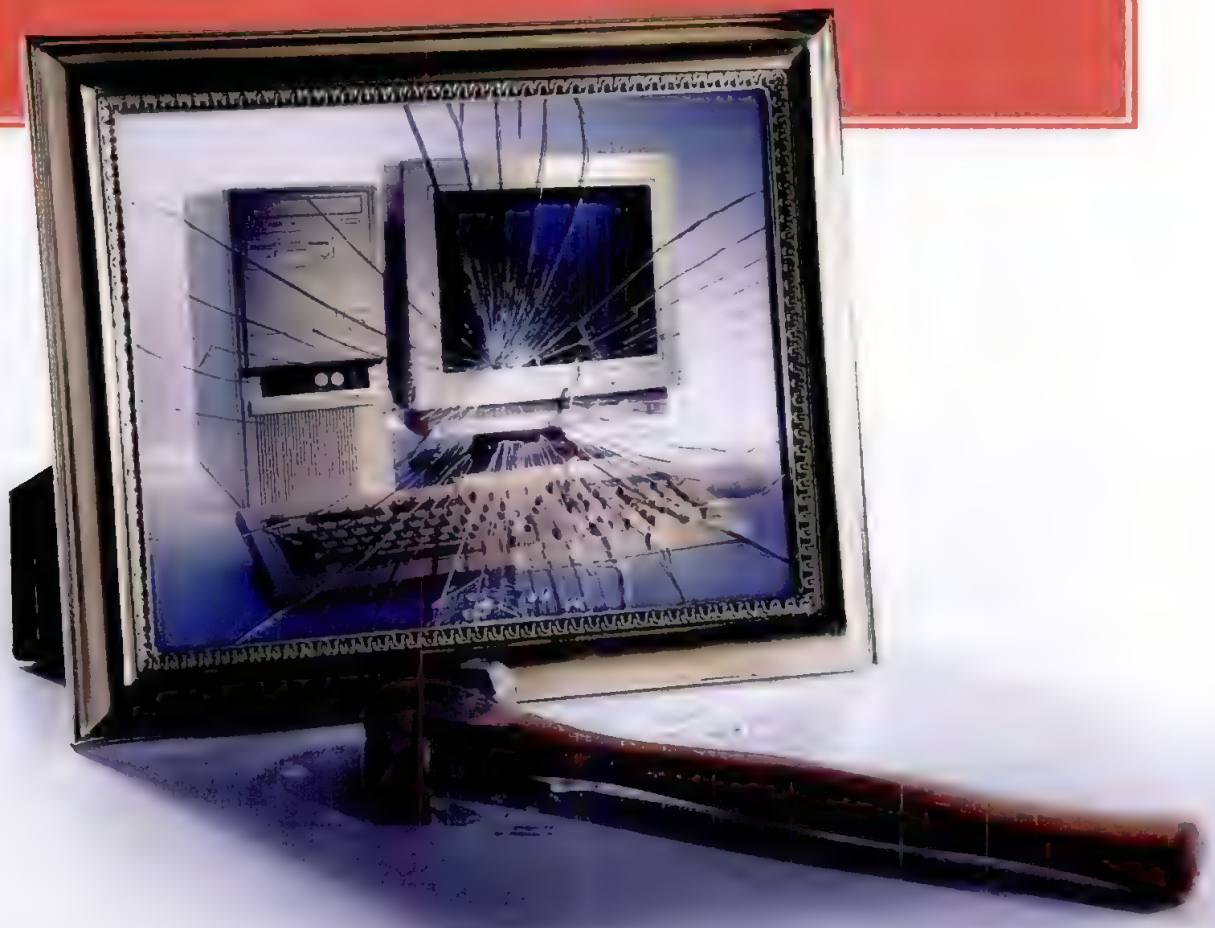
In Version 4, the choice is clear. If you want better control over viewing and navigation, IE4 should be your browser. *—Edward Mendelson*

PUSH/OFF-LINE BROWSING/WEB DESKTOPS

The once-burgeoning market for clever third-party browser applications such as off-line readers and push clients may be nearing an end as Microsoft Internet Explorer 4.0 and Netscape Communicator add these features and evolve into full Internet suites. We prefer IE4 for off-line browsing because of its better navigability. Communicator's Netcaster currently delivers better push content, but IE4 is more configurable.

Going beyond push, IE4 and Communicator want to Web-enable your desktop. IE4's integration with the operating system makes it a better Web desk-

Is lack of support ending your infatuation with your current P.C.?



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Windows Magazine, 8/97

Would you buy again?

Vendor	% who would buy the same brand
Dell	92%
Quantex	91%
Hewlett-Packard	88%
IBM	89%
Micron	81%
Gateway	80%
Acer	74%
AST	74%
NEC	71%
AT&T	69%
Digital	69%
Toshiba	61%
Compaq	58%
Packard Bell	51%

Windows Magazine, 8/97

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PC Magazine 7/97

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- Carrying Case

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top than Netscape's Webtop, but only if you don't mind partially upgrading your OS and learning a new way of using your system.

PUSH

The idea behind push channels is that content providers can send information from their Web sites directly to you. No matter how technically interesting the push vehicle is, the content itself has to be compelling. Netscape has the clear lead at this stage, with more than 700 channels and such premier content as ABCNews.com and MTV Online. Microsoft offers some exclusives, including Disney's Daily Blast and Wall Street Journal Interactive, and is actively trying to catch up in total channel offerings. By spring, the two companies' content offerings may be nearly identical.

A push application can be a definite disk-space hog. Both browser suites offer numerous options for control over channel updates and downloads, letting you set how deep to go in a site, how much cache to accept for any given channel, and how often you want the channel updated.

IE4 goes further than these basics, letting you set whether you want images, sound and video files, and/or Java applets and ActiveX controls to download with the update. You can also specify in IE4 that you want new content downloaded automatically, or that you simply want to be notified that the content is available.

OFF-LINE BROWSING

Because Web pages and push channels are stored on your hard disk, you can access them without an open connection to the Net. We preferred browsing off-line in IE4 because of its better off-line navigation and its integration of push content and browser content in the same window.

IE4 caches browser and channel content together, while Communicator maintains a separate cache for each. In other words, Netscape sees channel viewing as a separate activity from the browser, whereas Microsoft integrates the two.

This comes into play when you use IE4's History bar for off-line browsing. You can access every site you've visited, including channels you've downloaded, through this bar, which makes off-line browsing especially easy.

Dynamic HTML

HTML has come a long way from the simple language that Tim Berners-Lee developed in 1989. The latest modifications, all loosely grouped under the heading dynamic HTML (DHTML), bring your Web pages alive with true interactivity and without a performance hit. With DHTML, developers can write scripts that change the layout and content of your Web pages without having to generate a new page or retrieve one from the server.

DHTML pages can produce pop-up boxes that give additional information, effects such as changing colors and fonts on mouse-over, and text and graphics that scroll into position, making your Web pages more engaging. System performance will improve because DHTML cuts down on the number of round-trips between the server and client, and you don't need a plug-in.

Microsoft is much further along than Netscape is with its DHTML efforts, and it looks as if Microsoft's implementation will be closer to the impending standard. Even so, the importance of DHTML is impossible to determine at present. Before anything else, Version 4.0 of each browser will have to come into broader use in order to inspire widespread development.

More important, Microsoft and Netscape cannot agree on programming standards, and that could turn DHTML into an impossible dream. As things currently stand, you can't write a DHTML program of more than trivial complexity that will run correctly in both Microsoft Internet Explorer 4.0 and Netscape Communicator 4.0. Although some tools vendors are planning to create programs that will generate the proper code for either browser and determine which to use at runtime, this is not a viable situation long-term, and it's probably the worst possible scenario for developers.

DHTML can produce the effects it does because the browser exposes the elements on the page and style sheet, such as the fonts used and the position of elements, as separate objects. Then, a scripting language such as JavaScript or, in the case of IE4, any Active Scripting language, such as Jscript or VBScript, can access these objects and make changes on the fly.

The Document Object Model (DOM) is a set of classes that Web page scripts use to manipulate the browser and page. Both IE4's and Communicator's DOMs let scripts manipulate the fonts and positions of elements on a page. Unlike Communicator, though, IE4 exposes the actual content as part of the object model. A script can thereby actually change the text in a page. Communicator can change the text on a page, but it's both more difficult and less efficient than IE's more straightforward object model.

Both Microsoft and Netscape have committed to supporting the World Wide Web Consortium's efforts to standardize the core elements of DHTML, offering some hope that developers will one day write programs compatible with both browsers.—*Larry Seltzer*

WEB INTEGRATION

If making your desktop behave or look like the Web interests you, IE4 is your best choice. This assessment isn't based on Netcaster's failings, but rather on IE4's strengths. IE4 offers the Active Desktop, with a variety of Web-oriented features, while Netcaster's Web integration consists of the strong but limited Webtop.

You can turn Active Desktop on or off when you install IE4. That's good, because Active Desktop changes the fundamentals of the Windows interface: Internet Explorer becomes the Windows Explorer, making navigating your hard drive just like surfing the Web. You also have the option of changing the way you open files, folders, and programs to using a single-click instead of a double-click. To select an item you simply place the mouse pointer on top of it. (You can turn on the single-click feature by opening a folder and selecting View/Folder Options from the menu bar.) The result is a faster and

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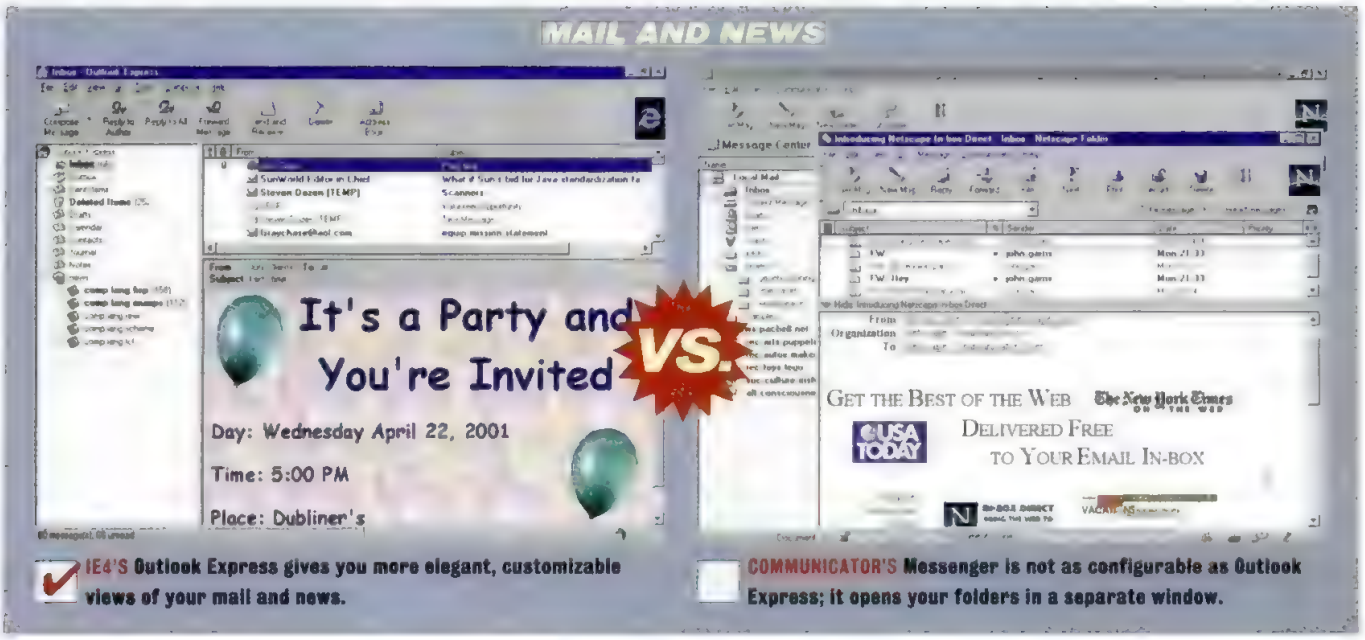
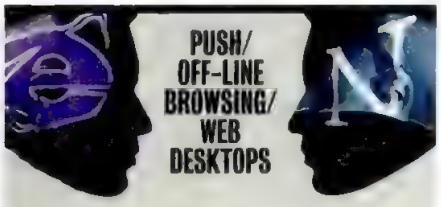


more intuitive way of interacting with your computer, but one that may take some getting used to.

Before moving to Active Desktop, you must consider whether you're ready to learn a new desktop navigation paradigm, and whether you want to accept what is essentially a partial upgrade of your OS. (For more details on IE4 as an upgrade to your system, see "Memphis & IE 4.0" in our issue of September 9, 1997.)

Communicator doesn't offer the Web-inspired interface enhancements of IE4, but for some users, of course, that is a blessing. Communicator does offer Webtops, channels that lock onto the desktop. A Webtop resides behind other windows and icons until you want to view it. Any Netcaster channel can be a Webtop, and it will be updated according to the channel options you set.

Because Webtops are controlled by JavaScript, they offer IS departments a way to establish common desktops across an enterprise, on all JavaScript-capable machines. For companies to which a Web desktop is appealing but are not yet ready to change the way their employees work, Netscape's Webtop can be a strong short-term solution.—*Neil Randall*



Good	**Push client**	Good
Good	**Channel availability**	Excellent
Excellent	**Channel customizability**	Good
Excellent	**Download scheduling**	Good
Good	**Web integration**	Fair
Good	**Web desktop**	Good
Good	**Off-line browsing**	Fair

We rate each feature for power and ease of use We consider whether each product has a particular feature and compare its implementation with that of the competitor and any third-party tools that may provide the same functionality.

MAIL AND NEWS

With the latest upgrades to their mail and news offerings, Microsoft and Netscape have finally gotten it right. Both products are well designed and worth using as one's primary e-mail and news clients. We preferred Microsoft Internet Explorer 4.0's Outlook Express to Netscape Communicator 4.0's Messenger and Collabra, due to Outlook Express's superior user interface and its slightly more extensive feature set.

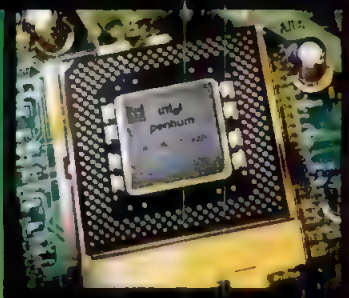
Outlook Express's interface is among the best we've seen. It features large icon toolbars that quickly direct you to most common actions, and it uses a three-pane interface that lets you easily scan messages and manage multiple folders. If you don't like the default layout in Outlook Express, it is fully configurable.

Although Messenger's interface is less customizable, it's still easy to use. Messenger creates one window, called the Message Center, that shows folders and mail servers, and it creates a separate window that shows message headers and contents.

If you use a lot of nested folders and are continually moving mail from one folder to another, then you'll probably prefer Outlook Express. We found that switching from one window to another to organize your messages is a more intuitive process in Outlook Express, which lets you navigate among various folders and view messages all in one window.

Outlook Express lets you consolidate e-mail from multiple POP3 or IMAP4 (Internet Message Access Protocol) mail servers into a single in-box, making it the choice for users with multiple mail accounts. You can also create rules that will move messages from different accounts into separate in-box folders. Unlike Messenger, Outlook Express also lets you import your existing Eudora, Microsoft Exchange, Netscape Mail, or Outlook mail messages and address books into Outlook Express.

If you get a lot of junk mail, you can specify rules that will let either program handle your e-mail automatically before you even see it. The Outlook Express implementation, however, is more useful:



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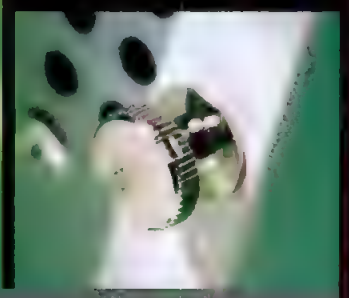

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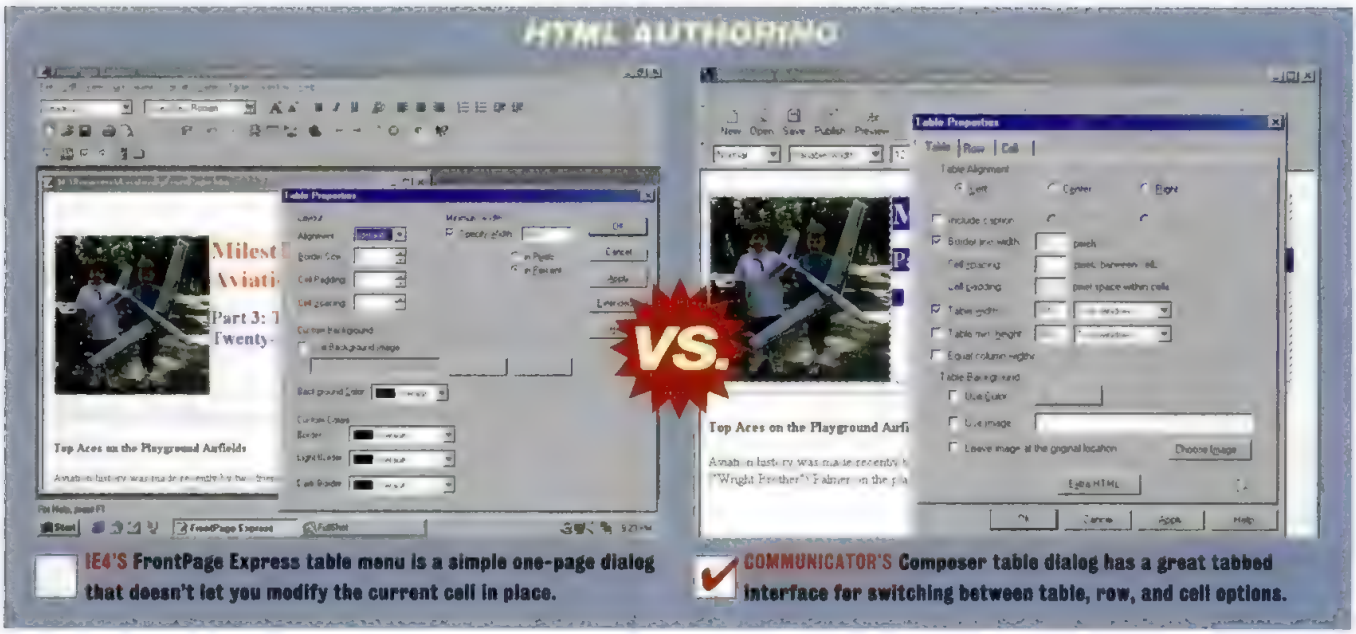
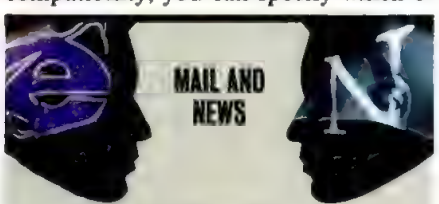


IE4'S FrontPage Express table menu is a simple one-page dialog that doesn't let you modify the current cell in place.

COMMUNICATOR'S Composer table dialog has a great tabbed interface for switching between table, row, and cell options.

It lets you forward e-mail to other addresses and delete messsages before they are downloaded from the server.

Both Messenger and Outlook Express can create and display HTML-based e-mail messages. Of course, HTML e-mail will only work with mail readers that support HTML—people using other readers, such as Eudora, Internet Mail (in IE3), or Microsoft Outlook are out of luck. For compatibility, you can specify which e-mail addresses in your address book support HTML, and send e-mail to other recipients in plain-text format.



Excellent	**Customizable interface**	Good
Good	**Message searching and sorting**	Excellent
Good	**In-box rules/filters**	Fair
Good	**Off-line support**	Good
Good	**HTML mail**	Good
Good	**Multiple-account support**	N/A
Good	**Address books**	Good
Excellent	**Mail import**	Fair

N/A—Not applicable. The product does not have this feature.

We rate each feature for power and ease of use. We consider whether each product has a particular feature and compare its implementation with that of the competitor and any third-party tools that may provide the same functionality.

With both products, reading NNTP (Network News Transfer Protocol) news is just like reading e-mail. The interface is the same, and newsgroups look just like regular mail folders. Communicator's Collabra, the news application, is actually the same client application as Messenger.

Neither product offers any special newsreader features. Newsgroup fans may find that dedicated newsreaders such as FreeAgent do a better job of managing messages and letting you specify specific messages for retrieval.

The remote capabilities of both products are adequate but they could be better. Both products here have off-line modes, so you can separate actions that require network traffic (such as transferring e-mail and getting newsgroup message headers) from those that do not (such as reading and composing e-mail). You cannot download e-mail headers only and then select which messages you want to retrieve, as you can in Outlook. You have to download everything at once, even if one of your messages contains a 1MB attachment.

Both Messenger and Outlook Express are mature enough to function as your sole e-mail messaging client, but we prefer Outlook Express because of its more impressive customization options and richer feature set.—*John Garris*

HTML AUTHORING

When you're ready to create your own Web pages, Microsoft Internet Explorer 4.0 and Netscape Communicator 4.0 are ready to help. Both suites include beginner-level HTML page editors that let you work in a WYSIWYG mode that shields you from obscure HTML syntax. Both IE4's FrontPage Express and Communicator's Composer offer basic HTML editing functionality, but Composer has a better balance of power and ease of use, and it is more closely linked to the browser.

Composer, unlike FrontPage Express, is so tightly integrated with the Navigator browser that the editing window looks and acts like a superset of the viewing window. Unique conveniences include an eraser tool that removes color and other attributes from selected text without making you reformat the surrounding text.

FrontPage Express offers many of the WYSIWYG editing tools included with the full FrontPage package, along with Office-style toolbars and menus. Convenient features include automatic conversion of any TIFF or .BMP image files dragged onto a page into Web-standard GIF or JPEG images. In Composer, you can drag GIF and JPEG files into the editor window from the desktop or browser and fine-tune image placement and formatting from a helpful dialog box that displays thumbnails of all major options.

Tables, including nested tables, are

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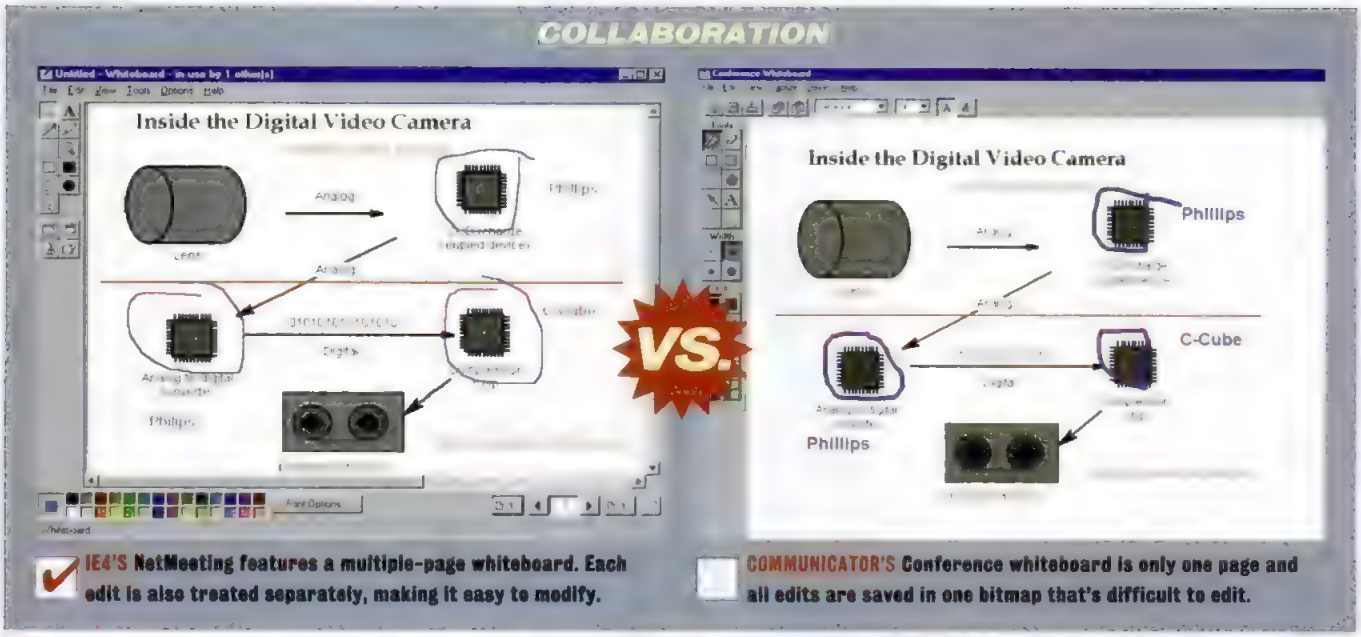
**Note: all x2 products are 56Kbps capable; however, due to FCC rules, maximum download speeds are limited to 53Kbps. Actual speeds may vary. Uploads travel at speeds up to 28.8Kbps. Requires x2 capable modem, x2 compatible analog phone line and x2 capable service provider. See www.usr.com/x2 for details.

*Free upgrades available on model nos. XJ1560, CC1560, XJ5560, and CC5560 through June 30, 1998. U.S. and Canada only. †Notebook with Windows 3.1x or Windows 95 speaker, microphone and sound capabilities required. Spectrum Connected, Inc. is a trademark of Spectrum Information Technologies.

SPECTRUM Connected™



IE4'S NetMeeting features a multiple-page whiteboard. Each edit is also treated separately, making it easy to modify.

COMMUNICATOR'S Conference whiteboard is only one page and all edits are saved in one bitmap that's difficult to edit.

easy to create and modify in both programs using point-and-click techniques, but Composer has a wider range of options accessible from clearer menus. Both editors have strong drag-and-drop functionality for creating hyperlinks.

FrontPage Express is definitely a stripped-down product. One feature available in FrontPage but not in FrontPage Express is the ability to preview the current page in your browser. Also, some dialog boxes in which you can fill in a filename don't have Browse buttons, so you must remember the filename you want and type it in by hand. Composer does not suffer from these problems.

Composer conveniently includes a spell-checker and a built-in file-transfer tool to send pages and related files to your Web site. FrontPage Express comes with Microsoft's Web Publishing Wizard, a tool for uploading pages that works well when uploading to many popular ISPs but can be confusing when working with sites the wizard doesn't specifically support.

You won't probably won't choose a browser because it comes with a free HTML editor, but Composer may be the only editor you need, while IE4 users will probably prefer a third-party editor over FrontPage Express.—*EM*

Excellent	**WYSIWYG editing**	Excellent
Good	**Image formatting**	Good
Excellent	**Text formatting**	Excellent
Excellent	**Link formatting**	Excellent
Good	**Table formatting**	Excellent
N/A	**Preview in browser**	Excellent
Good	**Uploading to Web site**	Excellent

N/A—Not applicable. The product does not have this feature

We rate each feature for power and ease of use. We consider whether each product has a particular feature and compare its implementation with that of the competitor and any third-party tools that may provide the same functionality

COLLABORATION

When you compare the collaboration features in the new Internet suites, they may seem identical. Netscape Conference and Microsoft NetMeeting both offer audio conferencing, whiteboard, text-based chat, and file transfer. Scratch below the surface, however, and you'll find that Conference's offering is a mile wide but an inch deep, while NetMeeting offers best-of-class functionality in nearly every feature. NetMeeting should be your choice unless you have a strong interest in personal and group scheduling (available only in Communicator Pro) or cross-platform support.

Limiting the utility of all Conference's features is its two-party, point-to-point architecture. In contrast, NetMeeting is multipoint, allowing three or more users to work together, though only two can take part in audio and videoconferencing at a time. During text-based chat, file transfer, and whiteboard conferences, Conference manages only two conferees, while NetMeeting supports multiple users.

Audio conferencing heads the list of features in which NetMeeting outclasses Conference. Microsoft provides a G.723 codec for low-bandwidth compatibility with products from Intel and other vendors. Conference doesn't, and it is a closed system at 28.8 Kbps and below.

NetMeeting 2.0 has videoconferencing, compatible with most capture cards and parallel-port cameras such as Connectix's QuickCam. Microsoft provides two codecs, supporting 28.8-Kbps and LAN-based conferencing. Conference doesn't support videoconferencing.

Conference can send voice mail, compressed audio files attached to standard e-mail. NetMeeting doesn't offer this feature. On the other hand, NetMeeting's Application Sharing—which Conference doesn't provide—is extraordinarily useful.

Application sharing lets multiple parties edit a document in any program, even if one participant's computer doesn't have that program. Application sharing also enables collaborative browsing, since multiple parties can share a browser and surf together, using a shared cursor to annotate

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166MHz MMX, 16MB RAM, 1.4GB HD $2,575.00	166MHz MMX, 16MB RAM, 2.0GB HD $2,795.00
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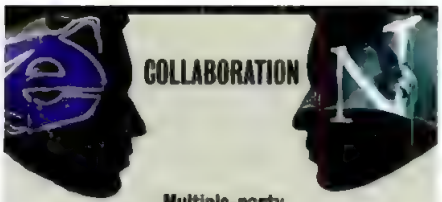


Fair	**Multiple-party support**	Poor
Excellent	**Internet telephony**	Good
Excellent	**Videoconferencing**	N/A
N/A	**Voice mail**	Good
Excellent	**Application sharing**	N/A
Excellent	**Collaborative browsing**	Good
Excellent	**Whiteboard**	Fair
N/A	**Scheduling**	Good

N/A—Not applicable. The product does not have this feature.

We rate each feature for power and ease of use. We consider whether each product has a particular feature and compare its implementation with that of the competitor and any third-party tools that may provide the same functionality.

Web content. Netscape's collaborative browsing simply sends a URL to the remote user's browser, with no sharing.

NetMeeting also dominates the whiteboard category. While Conference supports only one 800-by-600 page, NetMeeting provides multiple pages at higher resolutions. NetMeeting maintains annotations as separate objects that can be moved or edited, while Conference merges all markings into one hard-to-edit bitmap.

Differences in the text-chat and file-transfer tools are smaller, though Microsoft's multipoint capabilities remain a strong advantage. Netscape does have an advantage via Netscape Calendar, a proprietary personal, group, and resource scheduler. Microsoft has no similar entry.

Unless scheduling or cross-platform support is your most compelling need, NetMeeting (available separately) should be your choice of collaborative tools, irrespective of which browser you ultimately select.—*Jan Ozer*

JAVA

A year ago, serious Java applications were few and far between. With the Java virtual machines (VMs) in their latest browsers, both Microsoft and Netscape are attempting to create environments for serious computing. For those whose only concern is Java performance, we found that Microsoft's IE4 still has the faster Java VM. Navigator's VM did impress us with greater improvement between versions 3 and 4 than IE.

For deploying serious Java applications, both environments are strong, but because of the incompatible means of accepting signed Java applets, you may need to select just one platform based on whether you are a Microsoft Windows shop or in a cross-platform environment.

Both Netscape and Microsoft have given their version 4 browsers support for Java Development Kit 1.1, including the new Abstract Windowing Toolkit (AWT) and Java Beans, but Microsoft's support for JDK 1.1 is much more complete right now than Communicator's implementation. Netscape actually supports more of JDK 1.1 than Microsoft does, but only as a beta patch to Communicator. Final JDK 1.1 support should be integrated into a release version by the end of the year.

AWT operations are comparable in both VMs, but in operations that actually stress the VM, performance isn't close: Microsoft Internet Explorer 4.0 is much faster than Netscape Navigator 4. IE4's superior memory allocator and garbage collector serve well in most of our tests, as they would in real applications. In many tests, IE4's score was several times Communicator's. IE4 bested Communicator by more than 500 percent in our Hash Tables test, a memory-allocation and data-structure-manipulation exercise.

Microsoft has created a great deal of controversy in the Java world because of its effort to make its Java implementation the preferred method for running Java on the Windows platform. Microsoft gives developers access to Windows-specific features; its J/Direct technology lets you make direct native calls to Windows.

Microsoft's Application Foundation Classes (AFC) let you create pure Java that will run on any Java VM but will use Win32-specific features on a Win32 platform. Using AFC, a program can access all Windows' fonts instead of the few to which Java normally has access.

Whether you want to take advantage of AFC depends on how important it is to you that programs run consistently, even if in a diminished capacity, across all platforms. J/Direct is another matter. If you are a pure Windows shop and have no trouble committing to using Microsoft's VM, J/Direct has distinct advantages. If you need to use non-Windows operating systems or non-Microsoft virtual machines, J/Direct is not an option.

Both browsers have some new incompatibilities as well. The most significant have to do with signatures and access to privileged operations. Both VMs let you digitally sign Java code and have that code request permission from the VM to perform operations that would normally be denied, such as writing to the hard disk or establishing network connections to other sites. Unfortunately, Netscape and Microsoft use different signature formats and different methods of requesting capabilities, and both are different from the method used in Sun's Java Development Kit.

You still can't write once, run everywhere. Because you can't write privileged Java applets that will work in more than

JAVA BENCHMARK TESTS (JMARK)

▲ High scores are best. ▼ Low scores are best	AWT Graphics Mix ▲	AWT Blts & Images ▲	Vectors ▲	Hash Table ▲	Stacks ▲	Bubble Sort ▲	Quick Sort ▲	Towers of Hanoi ▲	Fast Fourier Transform ▲	Memory Allocation/ Garbage Collection ▲	Graphics Threads Seconds ▼
Microsoft Internet Explorer 3.01	2,166	689	1,764	4,355	1,611	3,060	16,511	1,193	717	266	15
Netscape Navigator 3.01	1,722	578	1,479	2,696	1,301	1,645	7,620	821	514	113	21
Microsoft Internet Explorer 4.0	2,165	1,584	4,555	12,143	4,701	5,602	32,739	1,530	938	760	11
Netscape Communicator 4.03	2,309	1,456	1,207	2,037	1,171	3,755	11,639	1,425	1,086	143	11

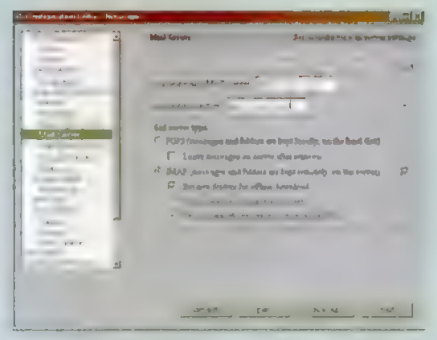
We performed these tests on a Pentium 133 Micron system with 16MB of EDO RAM and an ATI Mach64–based graphics adapter at 800 by 600 resolution with 24-bit color and running Microsoft Windows 95.

Administration: IEAK 4.0 vs. Mission Control

If you're deploying either Microsoft Internet Explorer 4.0 or Netscape Communicator 4.0 to your employees or your customers, you're going to need some tools to help customize and manage their use of the software. Netscape's Mission Control is a collection of applications for advanced site and user management for Communicator. Microsoft's Internet Explorer Administration Kit (IEAK), Version 4.0 (in beta when we examined it), provides similar capabilities for IE4.

Both Microsoft and Netscape target their tools at corporate administrators. Microsoft includes additional features that let ISPs and other third parties customize IE4 for their own purposes.

Netscape's tools aren't all that hard to use, but Microsoft's tools are more mature and straightforward. Some of Netscape's tools are command line–driven, and online help is thin or absent in others, but the documentation is extensive and clear.



Mission Control's configuration editor lets you make and lock global settings for users.

IEAK 4.0 is a free product, and Mission Control has a list price of $1,295, so if the ease and cost of rollout are of concern to you, IE4 is the clear choice.

Mission Control is a series of related but separate tools written mostly in HTML, Java, and JavaScript. The Configuration Editor lets you set preferences for your users, such as their server names. You can also set your users' software to check a central location for changes to these configurations or updates to the software itself.

Mission Control's JAR Packager and Page Signer let you package and digitally sign Java, scripts, plug-ins, and other types of code. The Install Builder, which works only in Windows and makes only Windows versions, lets you package all your customizations into a special version of Communicator for your users.

IEAK is a wizard that walks you through the steps of building a customized version of IE4. As with Mission Control, you can set customized defaults for most of the settings in the browser's options screen. IEAK also lets you set up the browser to read its options from a central management location.

Both tools offer robust solutions for deploying these Internet suites and allow you to disable the features that aren't important to your company.—*LS*

one browser, you are faced with the choice of committing to one VM, writing multiple versions, or not using privileged operations. If you don't want to relegate Java solely to trivial tasks or do double the work, you may have to commit to either IE4 or Communicator based on whether you are a Windows shop or not.—*LS*

SECURITY

Both Microsoft Internet Explorer 4.0 and Netscape Communicator 4.0 have improved the security features that you can actively use to protect yourself while you're online. Communicator gives the user a bit more control over the site-by-site security experience, but IE4's new security zones are easier to grasp for a new user.

With Version 3 of its browser—with the significant exception of plug-ins—Netscape always erred on the side of paranoia when it came to allowing users to perform potentially dangerous operations. On the other hand, security in IE has always followed the philosophy that you should be allowed to hang yourself, as long as you've been clearly warned. Communicator 4.0 essentially adopts the IE philosophy by letting users run code that performs privileged operations as long as that code contains a digital signature and the user approves the operation.

Both browsers have extensive security configuration screens. You can manage your security options with greater precision in Communicator, and your choices are more context-sensitive. IE4 lets users (and administrators) make broad decisions about security policy while allowing some decisions to be made at browse time.

Communicator has a Security Advisor that lets you set almost all security-related features from one dialog box. Conveniently accessible from the toolbar's Security button, the Security Advisor lets you view and verify certificates, manage your personal certificate (a digital identifier that proves you are you), and handle SSL and other encryption-related settings. IE4 lets you manage your certificate and verify the origins of files and sites using certificates.

You can globally shut out a number of potential Internet security hazards in both browsers. IE4 and Communicator let you shut off Java, cookies, and scripts, but Communicator can also flip the switch on style sheets. IE4 can prevent ActiveX controls from being downloaded to your system.

Communicator lets you set S/MIME (Secure Multipurpose Internet Mail Extension) preferences in the Security Advisor for rich and secure HTML-based mail from Netscape Messenger. IE4's settings for handling S/MIME-encrypted mail are accessible only from Outlook Express.

IE4's major security innovation is a feature called Security Zones, in which IE4 lets you classify Web sites as being in one of a number of zones (Local Intranet, Trusted Sites, Internet, and Restricted Sites). You then define the amount of trust you allow for a site in that zone. For instance, you might want to be able to go to any site on the Internet but not expose yourself to any dangerous capabilities.

IE4's approach lets new users set a comfortable level of security for themselves and thus avoid dealing with security on the request-by-request basis that Communicator offers to power users.—*LS* PC

Breakthrough Price

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Let's Go SHOPPING

ILLUSTRATIONS BY CAREN SCARPULLA

As 1997 draws to a close, to **browse** means to shop again—even on the Web. After **trawling** more than 150 e-commerce sites, *PC Magazine* **reviews** the 30 best.

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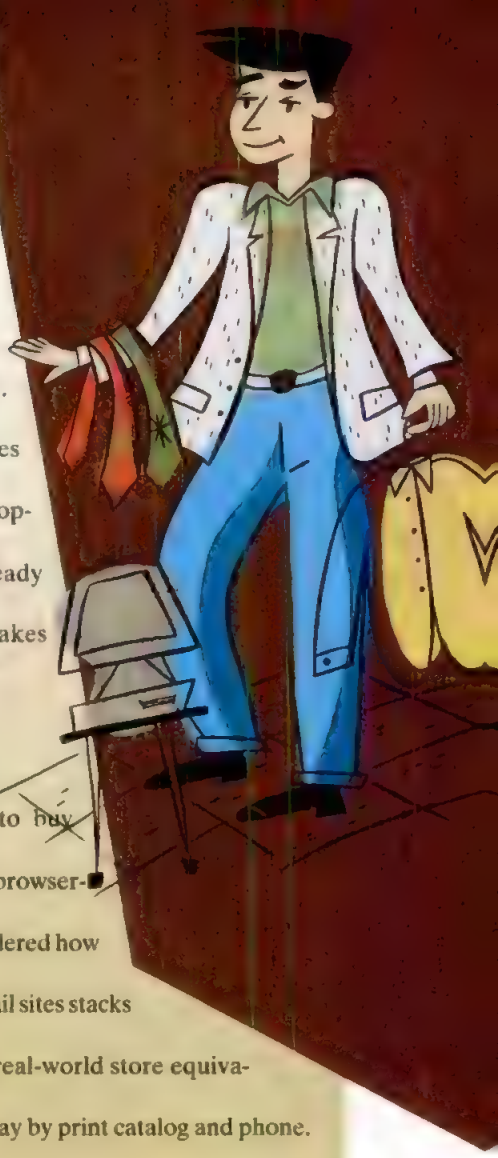


Retailers from all over are scrambling to set up shop in cyberspace. Spurred by the first wave of storefront-creation software products (reviewed in "Open for Business" in this issue), and inspired by the holiday gift-giving season, we've reviewed the best e-commerce has to offer.

We found that the choicest sites meet most if not all of the following criteria: They have fast-loading pages, elegant and easy-to-use layouts, extensive selections or hard-to-find merchandise, and robust search engines. Some include features that add a sense of community, such as forums and chats; others focus on personalization features, including customized accounts and e-mail reminders.

The most successful sites have a clear understanding of their mission. For stores that manage huge inventories, for example, a streamlined interface coupled with robust search capabilities is paramount. The best smaller specialty stores understand the importance of creating a unique atmosphere, often enhanced by useful information or historical background. Many of the best sites—Amazon.com, CompUSA, and Virtual Vineyards among them—manage to do both. As you'll see, the best sites also target both kinds of shopper: the one who comes ready to buy and the one who takes time to browse around.

By Timi E. Kistner

THE SHOPPING EXPERIENCE

Apart from the freedom to buy items at all hours using any browser-enabled computer, we considered how shopping at e-commerce retail sites stacks up against shopping at the real-world store equivalents, or the old-fashioned way by print catalog and phone.

We found that some retail models translate more effectively onto the Web than others. For stores limited to one location like De La Concha Tobacconist, a Web presence permits reaching countless customers via an environment that captures all the style and flavor of a Manhattan shop.

Currently, catalog sites in general present little if any improvement over traditional catalog shopping. Search capabilities for the Lands' End and L.L. Bean sites

proved to be harder to use and more time-consuming. The Eddie Bauer site is better, offering a sophisticated search engine and personalization features that add considerable value.

IN OUR SITES

To be considered for our story, a site needed to offer registered and anonymous browsing, a shopping-cart feature, and a credit card payment option.

We made an exception for car sites. Equipped with powerful search engines, AutoWeb Interactive, Microsoft CarPoint, and Online Auto make picking a car as easy as picking a necktie, offer financing, and stop just short of having you sign a lease.

We divided the pool of sites into seven categories, evaluating how well each site executed its mission within a given category. We didn't compare catalog sites with retail sites, for instance.

Cars

If you know the make and model of the car you wish to buy, here are the three best sites for doing the online legwork.

AutoWeb Interactive

www.autoweb.com

If you're looking for an efficient way to buy or sell a new or used car, AutoWeb Interactive may make you rethink traditional car-buying rituals. Unique to car sites, AutoWeb's AutoAgent service notifies you via e-mail when it unearths a deal you can't pass up.

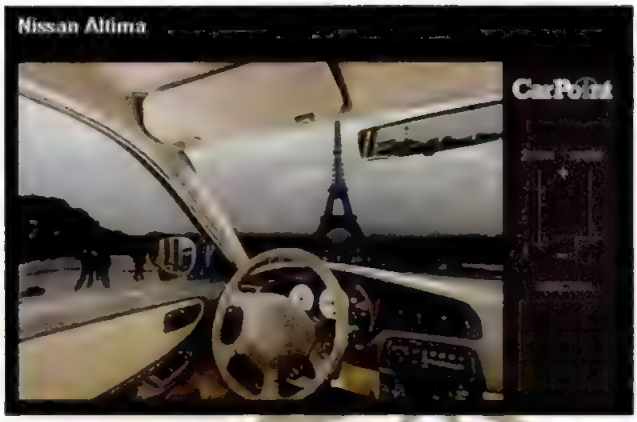
The search engine makes it a snap to locate your dream car: Simply type in the vehicle make and your ZIP code to yield a list of matching local dealers. If you're hunting for the perfect used car, the Used Car Finder's search engine lets you input up to three makes and models and a range of years and prices, in three geographical regions.

Tailor searches further by inputting a host of specific car options. You can even factor in the price of your trade-in vehicle based on its value as determined by the Kelley Blue Book. A Java-based loan calculator makes determining affordability easy. For $19.95, AutoWeb will post a listing of your current car for 30 days.—*Brett Krasnove*

Microsoft CarPoint

carpoint.msn.com

If you haven't settled on the make and model of your next car, go to Microsoft CarPoint. Car browsers and undecided shoppers will appreciate CarPoint's Sur-



round Video feature, a unique and fun way of virtually exploring the interiors of 55 different models. The site also offers a wealth of buyers' resources and mature online tools that will help you pinpoint the best choice.

There are two ways to shop at CarPoint. From Surround Video, you can link to detailed reports on specific models or to a dealer locator for finding where a particular model is available. The Find feature helps narrow down your selection by using a variety of criteria. Or if you have a specific car in mind, the New Car Buying Service—a search facility similar to AutoWeb's and Online Auto's—uses car models and zip codes to pull up a list of dealers stocking the vehicle.

CarPoint's loan calculator is slicker than AutoWeb's, with more options and functions. The CarPoint site also includes an unparalleled slew of product news, including magazine articles, top-ten lists, financing discussions, negotiating suggestions, safety and security explanations, and even consumer complaint stories.—*BK*

Online Auto

www.onlineauto.com

Online Auto is a fast-loading, mostly text-based site targeted at the no-nonsense contingent that knows exactly the right car in advance. It packs many of the same features as AutoWeb and CarPoint, including powerful search capabilities. The site's nearly graphics-free layout is efficient and quick-loading, and its search engine is impressive. Like AutoWeb and CarPoint, Online Auto also provides a link to a virtual lot of dealers, which you can sort out by state or vehicle make.

If you're hoping to sell your present car as well, bear in mind that Online Auto's free used-car ads might be enough to make some shoppers bypass the flashier competition altogether.—*BK*

Catalogs

Catalog sites compete as much against their own print sisters as against each other. Three manage to do both in style.

Eddie Bauer

www.ebauer.com

The best online catalog to date comes from Shop EB, the Eddie Bauer site. An outstanding design and a broad array of merchandise, as well as mature personalization features, make this a good alternative to print-catalog shopping. It's also a fine model for other catalog-site developers to emulate.

Our Contributors: TONI F. KISTNER is the associate editor for networking and communications. KAREN J. BANNAN is a staff writer; TROY DREIER, MICHAEL N. RUSIGNUOLO, and MELISSA J. PERENSON are staff editors; BRETT KRASNOVE is an editorial assistant, STEPHANIE LINDENBAUM is an editorial researcher, and FRANK J. DERFLER, JR., is senior networking editor of *PC Magazine*. ADAM ASCH is a communications specialist. CARLOS CARRILLO is assistant editor, and DAVID STROM is a contributing editor at *Windows Sources* magazine.

This site is a pleasure to browse; its frames-based interface keeps all pertinent product information to a single page. A large, detailed image accompanies each item, and new and sale items are clearly highlighted.

Registered users can take advantage of the customization features of EB Exclusive, which include storing personal information such as size and mailing address for use at the start of each order. You can set up e-mail reminders of important dates and enable the Wish List—a clever password-protected area in which you can add items that you'd like to be given as gifts. When you're through shopping, pay with a major credit card and select from ample shipping options.—*Melissa J. Perenson*

Lands' End
www.landsend.com

Everything you love about the Lands' End catalog comes together in its Web store to create one of the best online sources of clothing, shoes, and luggage available.

The merchandise is logically organized by category and subcategory, but the interface is based on a series of drop-down menus that make drilling to a particular item slow going compared with the Eddie Bauer site. This method may still be faster than flipping through the print catalog. The search engine can match whole-word or partial-word queries. And the Intelligent Order Blank automatically tallies the cost of your selections and checks them against available inventory.

Each product is displayed with an image and a detailed product description that includes instructions for proper care. Free swatches are available, as are alterations, and you'll find sizing charts and useful tips on getting the best fit. A variety of shipping options are available, and payment options are by credit card, phone, fax, or mail.—*MJP*

L.L. Bean
www.llbean.com

At the L.L. Bean site, you'll find over 600 of the store's most popular products in one easy-to-browse site. Merchandise is segmented into categories; each product is accompanied by a particularly crisp, well-saturated photo and a detailed description.

The frames-based design provides a handy toolbar at the bottom of the screen for accessing different site areas with ease. L.L. Bean's online shopper benefits include retaining your pertinent shopping and shipping information. Payments may be made via major credit card or L.L. Bean Visa, and products can be shipped in a variety of ways.–*MJP*

Computing

Of the dozens of online computing stores out there, three offer the best mix of features and content.

CompUSA
www.compusa.com

Shoppers seeking a massive product selection mixed with some fun will appreciate CompUSA's site. Browse all the computer shopping sites and you'll be likely to spend most of your time here.

The site is fast-loading (really fast), and the interface is slickly laid out and a breeze to explore, punctuated by powerful search capabilities. Products are accompanied by concise descriptions.

Lots of extras add to the buying experience. A weekly trivia contest offers the chance to win software. If you have a computing question, ask PC Modem, the resident online columnist. Kids will love the children's section, complete with its zippy outer-space design.

Our informal testing involved searching for a computer (the Power Macintosh 6500/275), a peripheral (the Diamond Supra Express 56E), and a software package (CorelDraw 7). CompUSA offered all three at prices just slightly higher than Computer Discount Warehouse, although the Power Mac was out of stock. Ordering was easy with major credit cards or CompUSA cards.—*Troy Dreier*

The Making of a Successful Storefront

What makes one e-commerce site take off while another languishes is hard to say. The best all share some common traits worth considering when building your site.

CREATE EASY-TO-NAVIGATE PAGES

Generally, good sites have a minimum of graphics and clutter, display navigational tools along the top or down the side, and offer a table of contents, maps, and indexes. All the sites are well designed to some degree, and Macy's e-ssentials and Eddie Bauer do a particularly good job of streamlining pages.

MAKE MERCHANDISE EASY TO FIND

Shoppers can't buy what they can't locate. Storefronts that hide merchandise behind a crowded home page or several layers of information will frustrate them. Build into your site the search capabilities that will let [illegible] advanced [illegible] using multiple criteria within music genres. Look to the car sites, as well as Virtual Vineyards, for other exam[illegible]ch capability.

OFFER PERSONALIZED SERVICE

Just as in the physical world, sites that deliver superior service get the buzz. The best ones provide purchase confirmation via e-mail, giving you a handy detailed record. Amazon.com will notify you when a book is available that matches your specific set of criteria. At American Greetings, you can sign and modify each card you send—even add a picture. If you provide American Greetings with a list of special dates and accompanying addresses, it will send you e-mail reminders and even mail the cards for you.—*David Strom*

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CIRCLE 052 ON READER SERVICE CARD

Computer Discount Warehouse
www.cdw.com

Bargain hunters unimpressed by bells and whistles will no doubt prefer Computer Discount Warehouse. Consistently low prices combined with a simple yet appealing interface and powerful search functions add up to one of the ultimate computing sites.

Search, Browse, and Compare functions make getting the best deal quick and satisfying. Weekly specials and manufacturers' coupons contribute to the amount that you can save. There's even an e-mail newsletter called Buyer's Edge that will alert you to sale specials. On our informal tests, all three products were in stock and were offered at the lowest innovative prices.

In addition, CDW provides product reviews and shopping tips culled from Ziff-Davis magazines. When it's time to buy, you can place orders with a major credit card either online, by phone, or by fax. CDW will also ship orders overnight or internationally.—*TD*

Internet Shopping Network
www.isn.com

Internet Shopping Network has been offering secure online transactions since 1994, and it still offers buyers a shopping experience at the cutting edge. New features like an impressive real-time auction, coupled with a smooth site and a fine selection, will appeal to many technically minded shoppers.

ISN's Computer Superstore is easy to browse, with pages laid out on a sparse, white background. Each product listing displays the real-time number of units in stock and is accompanied by a sharp image. The Download Store lets you buy and download software immediately.

The First Auction section makes use of new tools developed by Oracle and Sun to manage bids. As of this writing, ISN appears to have more auctions than bidders, which allows plenty of customers to come away with amazing deals, shipped to them via UPS.

All store merchandise is shipped nationally via Federal Express. On our informal tests, the Power Mac was out of stock, and prices were slightly higher than at CDW and CompUSA.—*TD*

Entertainment

Sit back and let the fun come to you. That order of books, movies, and CDs is on its way to your house.

Amazon.com
www.amazon.com

The leading online bookseller, Amazon .com has built an online resource full of literary news and opinion. Easy navigation, great selection, and personalization features unquestionably give Amazon an edge among the best.

The site's no-nonsense layout is light on style but quick to load and easy to use. Search capabilities are powerful, with jump points always accessible along the left side of each page. You'll find book reviews from a host of print and online publications, as well as articles penned by the Amazon.com Expert Editors, customers, even Oprah.

Amazon's personalization features are unmatched, serving as a successful model for other site developers to emulate. Fill out some checklists and forms and the Expert Editors will send you e-mail alerts on genres or subjects of interest. The Eyes feature will do the same when a favorite author releases a new title. Pay for your purchases with a major credit card or by check or money order; phone orders are also accepted. Shipping costs are $3.95 per order plus 95 cents for each additional book.—*Carlos Carrillo*

BarnesandNoble.com
www.barnesandnoble.com

Slow-from-the-gate challenger Barnes & Noble has taken a slightly different though equally impressive approach to its book site. Whereas Amazon.com focuses on one-on-one interaction, this bookseller has built an online community reflective of the casual reading-room atmosphere its real stores are known for—sans coffee bar and overstuffed chairs.

As a hub that connects readers via literary forums, events, and live online interviews, the Barnes & Noble site occupies a unique place in the online book world. Not surprisingly, design, navigation, and search functions are strikingly similar to Amazon's—down to the fonts at times.

Barnes & Noble also supplies personalization features—notably the Personalized Book Recommendations agent which tailors book suggestions to your taste—but as of this writing, they're less developed than Amazon's.

Orders are accepted by credit card online or by phone, or fax (though we don't normally recommend faxing credit card information). Shipping is $3 plus

95 cents for each book, which is essentially the same as Amazon.com's policy.—*CC*

Bargain Book Warehouse
store.bargainbookwarehouse.com/cgi-bin/sodacreek.storefront

Bargain Book Warehouse's bare-bones approach to online bookselling beats the big guys where they live—by offering a flat shipping rate of $4.25 per order. The site's design, navigation, and load times are outstanding, though the stock is somewhat less extensive.

In an informal price comparison, we ordered Robert A. Heinlein's *Starship Troopers* at each site. At Amazon and Barnes & Noble, the price was $4.79 plus shipping, for a total of $8.74. Barnes & Noble, however, charges sales tax in states with stores, so our New York purchase totalled $9.46.

Bargain Book Warehouse charged $5.39 plus $4.25 shipping, for a total of $9.64, indicating that you need to buy in bulk to benefit from the flat rate. But shipping for eight books from Amazon .com and Barnes & Noble will cost you around $10, compared with Bargain Book Warehouse's $4.25.—*CC*

SAMSUNG
monitors

SIMPLY BREAKING NEW GROUND.

Samsung announces a breakthrough in monitor technology with its "p" series professional monitors. Building on its award-winning technology, the new space age design of these high-powered monitors features Samsung's unique Display Director™ on-screen control system for advanced screen adjustments. Free Colorific® Color Matching software and a special ARAS UltraClear™ screen coating provide precision color with the sharpest, clearest, brightest images possible. With a 230MHz bandwidth, the 1000p offers superior performance with an ultra-fine 0.25mm dot pitch and completely flicker-free resolutions up to 1600 x 1200 at 85Hz. TCO '95 compliant, SyncMaster™ "p" series monitors are compatible with all platforms and conform to the latest plug and play standard (DDC 2B+). Samsung's 24-hour/7-day live telephone support is available to handle any service needs or questions. Simply breaking new ground. Simply Samsung.

MODEL	1000p	700p	500p
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PITCH	0.25MM	0.26MM	0.28MM
WARRANTY	3 YEARS*	3 YEARS	3 YEARS

For more information, call 1 800 933 4110 or visit our web site at www.sosimple.com

CIRCLE 033 ON READER SERVICE CARD

*21" monitor includes a one-year on-site replacement warranty. ©1997 Samsung Electronics America, Inc. Software featured is 3D Studio MAX®, from Kinetix. Colorific is a registered trademark of Sonnetech, Ltd., San Francisco. All other brand, product and service names and logos are trademarks or registered trademarks of their respective manufacturers and companies. Ad: Arnell Group

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June 1997 21GLs

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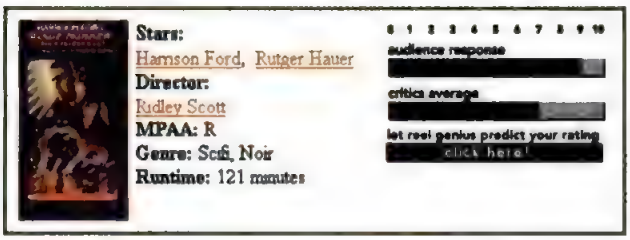
Reel

www.reel.com

The "planet's biggest movie store," Reel offers more than 35,000 videos for rent and 80,000 for sale—at lower prices than you'll spend around the corner. In addition, Reel's unique services and unsurpassed search capabilities help make it the definitive site for all things cinematic.



Whether you know the title you want or need some guidance nailing down what kind of film you're in the mood for, Reel's multiple search capabilities are far and away the most impressive we've seen. Most notable is the CineMap environment, which uses Perspecta's 3-D visualization technology PerspectaView to lead you to a pool of movies that will suit your criteria.

An effective blackout design helps to facilitate quick page loading. Encyclopedic information on movies and their stars, plus hundreds of movie reviews penned by Reel staffers, is sure to satisfy the most knowledgeable student of film. For those who yearn to join the ranks, Reel offers extremely cheap virtual classes in film theory at Cinema U ($10 for a mini-course, $15 for a full course).

Rental prices are sure to make both the nationwide chains and mom-and-pop video shops nervous. Reel charges $2 to $3 a week per title, plus shipping (depending on volume). You can also buy titles at discount prices for VHS, laserdisk, and even DVD. Payment options include major credit cards, checks, and money orders.—*Michael N. Rusignuolo*

@Tower

www.towerrecords.com

Of the many online music stores, @Tower, CDnow, and Music Boulevard offer selections rivaling those found in many real-world music stores as well as powerful search facilities, and original added features and content. All this adds up to sites good enough to make the traditional stores squirm.

@Tower's simple-to-navigate site lets anyone with a Web browser shop this virtual Tower Records store. Quick Searches make it simple to sort the 150,000 titles by artist, title, song, or producer. Each listing is accompanied by cover art and informative listings. Our informal tests included the purchase of five CDs, which totaled $69.95. Because Tower has stores in New York, we were charged $5.43 in sales tax. Shipping options included $4.95 for 2- to 3-day delivery (or $7.95 for overnight), rounding out our total to $76.33.

Online-only services abound, such as promotional and collectible giveaways, QuickTime videos, and RealAudio sound bytes, making @Tower a tempting choice even for shoppers with a Tower Records nearby. Pay for your purchases with a major credit card.—*Stephanie Lindenbaum*

CDnow

www.cdnow.com

With its collection of over 215,000 CDs and 35,000 videos as well as added content, low prices, and singular features such as the Lunchbox, CDnow is tough to beat—both on and off the Web.

The site is intelligently designed, with everything you need right up front. Graphics are small and used sparingly, contributing to fairly fast loads and easy navigation. The CDnow's search engine, FastFind, lets you search by artist, title, song title, or record label. Here, our test albums cost $64.45, plus $4.45 for 1- to 3-day shipping, for a total of $68.90.

Unique to CDnow is the Lunchbox, a special section of the shopping cart where you can store items over multiple visits. Extensive payment options include a choice of six credit cards.—*SL*

Music Boulevard

www.musicblvd.com

Fans of VH-1 and MTV (with which Music Boulevard is affiliated) will be quick to love the eye-catching design and extensive music news at the Music Boulevard site. Make no mistake: Behind the cool veneer is a rock-solid site with features and selections that make it serious competition for real-world stores.

You'll find over 185,000 CDs and tapes culled from multiple genres, as well as swift and easy-to-use search controls. In most cases, each item is accompanied by cover art, as well as the artist's discography. Selected tracks are available for preview via the RealAudio plug-in.

No matter where your search leads you, the seven opening departments are always available at the bottom of the screen. Search boxes for a particular artist

Shop Safely in Unknown Corners

Buying online is anything but new. Small sites have been selling an eclectic array of merchandise on insecure servers long before Fortunoff and Macy's e-ssentials came online. Here are some ways to ensure that you're buying from a legitimate site.

First, take a long look at the welcome page. Note the number of links to other sites, as well as the nature of those sites. Ties to associations, guilds, or other organizations denote legitimacy. Also look for BBBOnLine, TrustE, and VeriSign Digital ID logos. These organizations work to maintain security and integrity on the Internet, and they let members post a logo linking back to their pages. If the logo or link isn't clickable, it may be pirated.

Try to learn how long the site has been in business. If you can't tell, send the proprietor an e-mail query. Next, check the Usenet boards to see if there are any flames (complaints) posted against the site, and then post your own follow-up query.

Also look for a variety of payment schemes offered—credit card using a secure server, phone, personal check, or money order. Some sites also let you mail in your credit card information. If you're asked to e-mail this information, don't; there are countless ways for hackers to intercept it.
—*Carlos Carrillo*

appear often, speeding up inquiries considerably. Our test CDs totaled $68.05. Shipping options included 4- to 8-day service for free, 2- to 3-day for $4.94, and 1- to 2-day for $6.19.

Music Boulevard accepts a generous array of payment methods, including checks, money orders, and major credit cards. You can also order via phone. As an added customer service, Music Boulevard offers to keep your customer data private, and it will guard your e-mail address from unwanted solicitors.—*SL*

Food/Wine/Cooking

Here are the best places online to buy everything from a can of tomato soup to a bottle of chardonnay or a 10-quart double boiler.

Chef's Catalog

www.chefscatalog.com

If you're a fan of the print version (around for nearly 20 years) or a home chef searching for the best professional-quality restaurant equipment, look no further than Chef's Catalog. Here, you'll find the best selection of products—everything from an Italian Pizzelle Chef Baker to a ten-piece pots-and-pans set—packaged at an easy-to-navigate site.

Categories are broken down intelligently. Sections include gifts, cookware, cutlery, chefs' tools, exciting electrics, and Super Sale; daily specials are spotlighted on the front page. Each item is accompanied by a large, relatively crisp image and a detailed description.

The merchandise has a decidedly European bent, with strong representation by such companies as Bourgeat, Henckels, and Krups. You'll also find excellent tips for optimizing your kitchen equipment, as well as a section where you can e-mail questions to a professional chef—all of which enhances the value of the print catalog.

Add items to your shopping cart as you go. Purchasing requires you to register, but once you do, Chef's Catalog will e-mail you a receipt of your transaction.—*MJP*

Kosher Grocer

www.koshergrocer.com

Whether you're kosher or you simply appreciate the finest fresh pasta and imported goat cheese, the Kosher Grocer site is the best source on the Internet. Slickly designed and easy to navigate, the selection is extensive and exotic, with prices at or below what you'll find in the average New York kosher deli.

Laid out like a traditional kosher kitchen—with dairy items separate from meat—the foods are categorized thoughtfully and logically. There's also an ample selection of hard-to-find spices and flavored olive oils. Under each category, each product is accompanied by a large low-resolution image that is quick to load and displays sufficient detail. Click on the image to bring up a short, meaningful product description.

Clearly marked prices are competitive with the brick-and-mortar variety of shop. Add items to your shopping cart as you go, and don't forget the $20 minimum. After you pay for your order with a major credit card, Kosher Grocer will ship it to you overnight via Airborne Express. —*Karen J. Bannan*

NetGrocer

www.netgrocer.com

Would you ever consider doing your weekly grocery shopping online? Granted, the idea of having your staples delivered via FedEx is unconventional, but the NetGrocer site is so well conceived and executed, it's sure to make you rethink the way you shop for food. The first nationwide online grocery store, it has been around only since last July.

NetGrocer's thousands of items are artfully and thoughtfully arranged by category. Each item has a corresponding image, price, and size, as well as dimensions and nutritional data. A robust search engine lets you sort out items by 14 different variables, including brand, size, price, calories, fat, and sugar.

Navigation is slick and instinctive. Personalized features include the ability to create shopping lists for reuse, set up recurring orders, and send food to others. We especially liked the live cash register

in the lower right-hand corner, which keeps a running tally on the cost of your purchases. At checkout, pay for your groceries with any major credit card. Your food will be delivered within four days via Federal Express. Shipping costs $2.99 for the first 10 pounds and only $.99 for each additional 10 pounds.—*KJB*

Virtual Vineyards

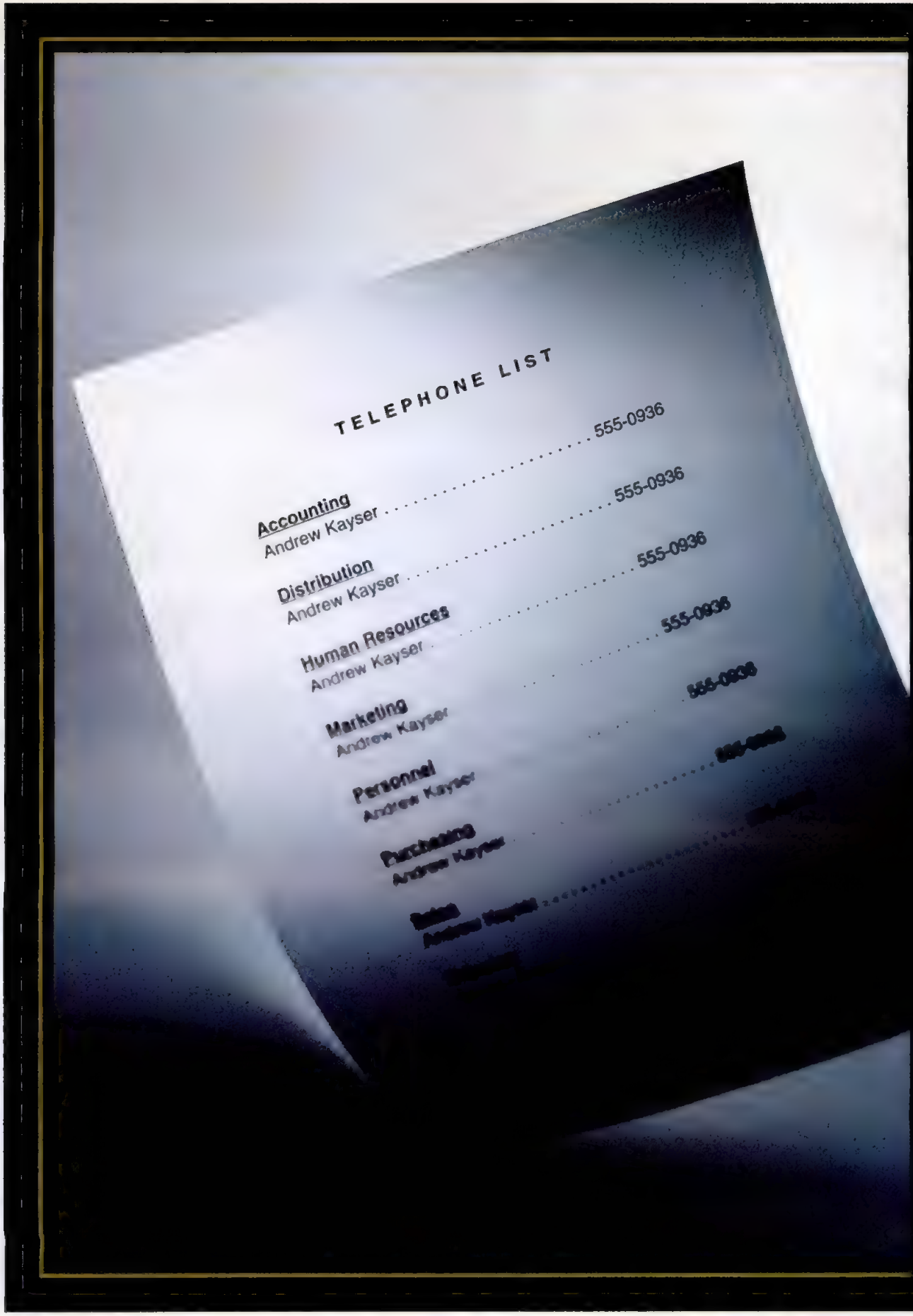
www.virtualvin.com

Virtual Vineyards is the definitive site for all things related to wine. Begun over two years ago as an online service, it provides an abundant selection of wines and gourmet food. In addition, it's full of useful information and seasoned advice unavailable at your corner wine store.

The site lets you search by various criteria or browse the Instant Pick section. Here, a wine is highlighted—complete with description and history, as well as an accompanying chart detailing flavor intensity, acidity, body, and complexity. If a term is unfamiliar, simply click on it to bring up a detailed explanation.

Surprisingly, wines only scratch the surface of Virtual Vineyards' offerings. There are various gourmet foods, candies, and preserves, with detailed menus (for party planning), recipes, and appropriate wines. If you need guidance, informational columns provide quick answers, or you can e-mail Virtual Vineyards' staff of experts.

Payment options are the most extensive of all the best sites (including Cybercash, credit cards, and CompuServe Wallets). The site also supports VeriSign Digital ID for secure transactions. —*Adam Asch*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Wilderness Coffee House

ww.wilderness-coffee.com

Forget choosing between flakes and crystals. At the Wilderness Coffee House, you'll be torn between Guatemalan Antigua and Ethiopian Longberry Harrars. Famous in the Midwest, the Maple Grove, Minnesota, store has brought its abundant selection of blends, roasts, and specialty teas as well as coffee-related paraphernalia online—producing the authoritative coffee-bean site.

The site is concisely designed and easy to navigate. Each item is accompanied by a detailed description. You'll also find welcome explanations of formal coffee-tasting terms, as well as the history and origins of your chosen bean.

Significantly, to ensure peak flavor and freshness, the beans are roasted in small batches every Wednesday morning to fill online orders processed the previous evening before 9:00 central time. Buying beans is as simple as checking off a box, which adds your choice to the shopping cart. You can place your major credit card order by phone during business hours or online.—*AA*

Retail & Department Stores

Forget the limitations of geography. Now you can shop some of your favorite stores from anywhere, at any time.

Fortunoff

www.fortunoff.com

Unless you have explicit confidence in the source, you might not consider purchasing fine jewelry over the Internet. But with 75 years in the bauble business, Fortunoff is well positioned to change your mind. This outstanding site provides the best viable alternative we've seen to real-world jewelry shopping.

Aside from a simple and elegant design, what you'll find particularly striking here is a large high-resolution photograph accompanying each piece—rivaling the prints you'd find in a glossy catalog. For users with bandwidth concerns, Fortunoff's low-bandwidth version offers smaller images that are sharp and clear. The sizable collection of jewelry is grouped logically in eight categories, including gold, diamonds, and cultured pearls.

We especially liked that all diamonds are accompanied by clearly marked color and clarity ratings. Also notable is the Shop By Price search feature, which lists all items available in ascending order of price. Fortunoff lets you pay with any of six different credit cards—one of the widest selections we've seen. And it will wrap your gift in posh metallic paper with ribbon at no extra cost.—*KJB*

JCPenney

www.jcpenney.com

JCPenney is famous for its family-friendly personality, expansive in-store inventory, and comprehensive catalogs. Before long, it may also become renowned for its excellent online store as well. JCPenney has successfully leveraged its catalog experience to create an online department store offering everything from toasters to pillows to dresses from one convenient browser window.

The site is clearly designed, concise, and functional. Items are grouped by department, such as Men, Women, House and Home, and Electronics, making the shopping experience similar to that in brick-and-mortar stores. Each product is accompanied by a small high-resolution image and a useful description.

Pull-down menus made it extremely easy to buy a pair of jeans in the right size, and we appreciated the online-only coupon for $3 off if we bought two or more pairs. You can use any major credit card or your JCPenney card to ring up your order. In addition to the shopping areas, there's a gift registry, online sales and specials, and Internet-only coupons. Links to flower shopping and the store's retail hair salons and photography studio round out this extremely comprehensive site.—*KJB*

Dig Before the Deal

The Web is a rich resource for making information-intensive deals in real estate, stocks, and airline tickets.

Local ISPs offer extensive real estate information by bundling links to realty listings, chamber of commerce information, mortgage broker listings, sale-by-owner listings, maps, even county tax records. Yahoo's classified section and CyberHomes (*www.cyberhomes.com*) are among the many sources with listings from realtors and private sellers. At Real-Estate-Web.com (*www.real-estate-web.com*), you'll find hundreds of links to real estate–related sites.

Buying stocks on the Web is big business. Hundreds of financial sites as diverse as CNNfn, Microsoft Investor, Quote.com, and USA Today Money offer personalized information pages, advice, portfolio tracking, e-mail notification, and other services. Be careful, though. Earlier this year, the Federal Trade Commission issued warnings to 215 sites about deceptive advertising.

When you are ready to trade, Charles Schwab & Co, eBroker, E*Trade, and PC Financial Network can conduct trading at prices that make flesh-and-blood brokers grind their teeth.

Great deals on airline tickets—as well as information on availability and convenient connections—can be found at sites such as Microsoft Expedia and Travelocity. The Ecola site (*www.ecola.com/travel/airline*) provides links to all major airlines, and TheTrip.com (*www.thetrip.com*) offers useful information, including position reports of flights in the air.

Surprisingly, many airlines dilute the value of their Web sites. Delta Airlines, for example, uses an inordinate amount of bandwidth on airplane pictures and corporate hype.

In an upcoming issue, *PC Magazine* will serve up a story on online travel sites.—*Frank J. Derfler, Jr.*

"We do a live update for thousands every week.

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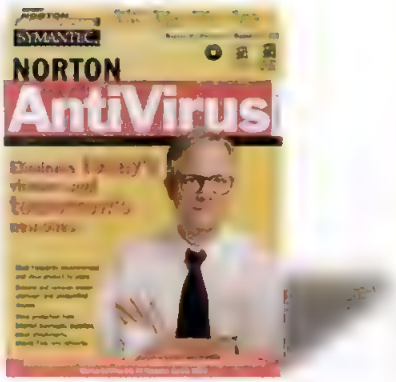
Every week, Tom King's CompuTalk® geek-free radio program updates thousands of listeners on the best stuff in computers. And every week, Tom updates his antivirus protection with Norton AntiVirus.™ "Thanks to LiveUpdate," Norton AntiVirus automatically updates itself on the Web with a click of a mouse. So we're always protected. And that's important because over 200 new viruses are written every month." Join the thousands of computer users who protect themselves with Norton AntiVirus. [illegible] And get antivirus protection that's always up-to-date.



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Macy's e-ssentials

www.macys.com

Department stores have been slow to build e-commerce sites, especially those stores unable to draw on an established catalog business like JCPenney. You won't find Bloomingdale's or Sears selling online, but you will find the Macy's e-ssentials shop. Macy's offers the basics (panty hose, underwear, socks, button-down shirts), coupled with personalized services. This unique combination results in one of the best e-commerce sites we've seen.

Items are depicted by stylish line drawings that load quickly and offer plenty of detail. Customized features that you won't find elsewhere include the ability to have items sent to you automatically every month. And notably, if an item is on sale at the store, you'll automatically be charged the sale price online—a feature we haven't seen elsewhere.

Extra touches that round out this site include a personal make-up consultation via the Clinique site. You can even order Macy's gift certificates in $50, $100, and $200 denominations. When you're finished shopping, you can pay using any major credit card.—*KJB*

OfficeMax Online

www.officemax.com

With its utilitarian design and wide selection, OfficeMax Online is the best place on the Web for buying anything from pencils to ink cartridges to computers without ever jumping into your car.

Over 7,000 products are displayed in a hierarchy of lists that make quick work of drilling down to the specific item you want. Each product is accompanied by a clear picture and a short, useful description.

The ability of users to track purchases from the Web site, as well as to create template order forms for regularly purchased items, makes OfficeMax Online an excellent alternative to traditional shopping. When you've selected an adequate supply of staples, submit your order in the checkout area and pay by major credit card.

Although OfficeMax's design is well conceived and easy to search, we often had to reload a page several times before we could browse its contents.—*KJB*

Specialty Stores

From humidors to virtual pets, these online shops offer an eclectic array of merchandise you won't find at the mall.

Aardvark Pet

www.aardvarkpet.com

Get a gift for your favorite dog or cat at Aardvark Pet. Toys, clothing, books, and more are all a click away—everything from food for real animals to virtual pets. Other pet sites include products for the parakeet and hamster contingent, but Aardvark's quick, attractive, and sleek interface, as well as its copious product line, makes it far and away the best.

The friendly site uses fun icons and has an intuitive design. In a sense, Aardvark is weighted down by its extensive inventory,

listing all the products in long, vertical lists that require serious scrolling. Nonetheless, the current setup is quick-loading and redeemable with Today's Deal offerings at the top of each page. Each product is only a click away, and navigation is a snap.

Click on the buy-it icon to put items in your shopping cart; at any point you can check out. A nice touch here is the ability to attach a gift message to each purchase. Several ordering options accommodate the security-squeamish, ranging from secure credit card transactions to an 800 number.—*MNR*

American Greetings

www.americangreetings.com

Who needs a personal assistant when you have American Greetings online? Much more than a card shop, the site offers personal services that are unsurpassed. You can stock up on a year's worth of cards and personalize each one with a message and a photograph. As that's not enough, American Greetings will even address, stamp, and mail your cards for you so they arrive on time for those birthdays and anniversaries.

Beyond customization, the site is streamlined and easy to navigate, and it offers a huge, eclectic selection of cards at competitive prices (around the $3 mark, including postage). There are cards for every holiday and milestone in life, as well as gifts, chocolates, and gift baskets.

Members benefit from an online address-book feature that saves all your recipients' information for future use. You can access the site's online e-mail reminder service so you won't forget an important date or occasion.

Purchasing your card selections is half the fun, because you get to personalize each one—adding text, a customized greeting, and a signature. When you're all finished, you can pay for your purchases with any major credit card.—*KJB*

Andy's Garage Sale

www.andysgarage.com

Typically, garage sales are where you can pick up odd items at bargain prices. Andy's Garage Sale is no different, except that you're not buying other people's castoffs but browsing what's brand-new. Of the sites we found that offered a variety of bargain merchandise, Andy's voluminous and worthy stock, as well as its organization and design, set it above the rest.

Andy's Garage Sale sells overstocks and tail-end inventories. The site has a decidedly homemade feel to it, but once you move into the product pages, you'll find some serious inventory. Item lists are displayed in easy-to-read tables hyperlinked to additional product information, so browsing is quick and painless. Click on an item to read a highly detailed fact sheet that provides more information than you'll ever need to

know about your chosen product.

During our shopping trip, we found a $37 king-size comforter set, a $17 women's Crayola Musical Watch, and a pair of $31 gold-and-diamond earrings. You can use your credit card to order by snail mail, fax, or phone. Each order will set you back $4.95 for shipping and handling, but if you order multiple (or heavy) items, that's a bargain too.—*KJB*

De La Concha Tobacconist

www.viamall.com/delaconcha

Two hot trends come together as stogies meet the Web at De La Concha Tobacconist. The venerable New York tobacco shop has been around for 33 years but just put up its cyber-shingle last January.

Plenty of sites on the Web sell tobacco, but none offer such a wealth of products packaged in an elegant and quick-loading interface. Shadowed graphics and muted colors help create a mood so completely in the spirit of its wares that you can almost smell the smoke. A graphical navigation bar at the top of each page keeps you one click away from your shopping cart, a search engine, and additional products. You can toss your purchases in the cart as you go, remove things you decide against later, and then place your order on a major credit card.

Products are logically grouped in categories and subcategories, making it quick business to find what you seek. The rated selections will satisfy even the most finicky of tobacco aficionados. De La Concha also contains a wealth of anecdotal information in each section, such as the University (for practical and philosophical works on the joys of tobacco) and the Museum (which features a display of historical tobacco brands). All of this adds up to a most useful, enjoyable, and even educational experience.—*MNR*

1-800-Flowers

www.1800flowers.com

If you don't have time to smell the roses at the corner florist but are uncomfortable sending that special someone a bouquet or gift basket sight unseen, 1-800-Flowers is your answer.

Peruse 150 floral arrangements and gift items at this clearly laid-out site. Each includes a detailed description and a large image. Online extras include a floral reference-and-information section and the Fresh Thoughts e-zine, where you'll find flower factoids, tips on floral arrangements for birthday parties, and suggestions for what to say on the card. There's even a calendar that highlights flower-giving occasions (June is national rose month, for instance), as well as a Gift Reminder Service that alerts you five days before a bouquet-sending date.

Ordering from 1-800-Flowers is easy; a handy calculator automatically tallies your purchases as you go along. Orders received before 1:00 P.M. are guaranteed same-day delivery anywhere within the United States and Canada, and the $5.99-per-order service charge is 50 percent less than the price charged to telephone customers.—*AA* PC

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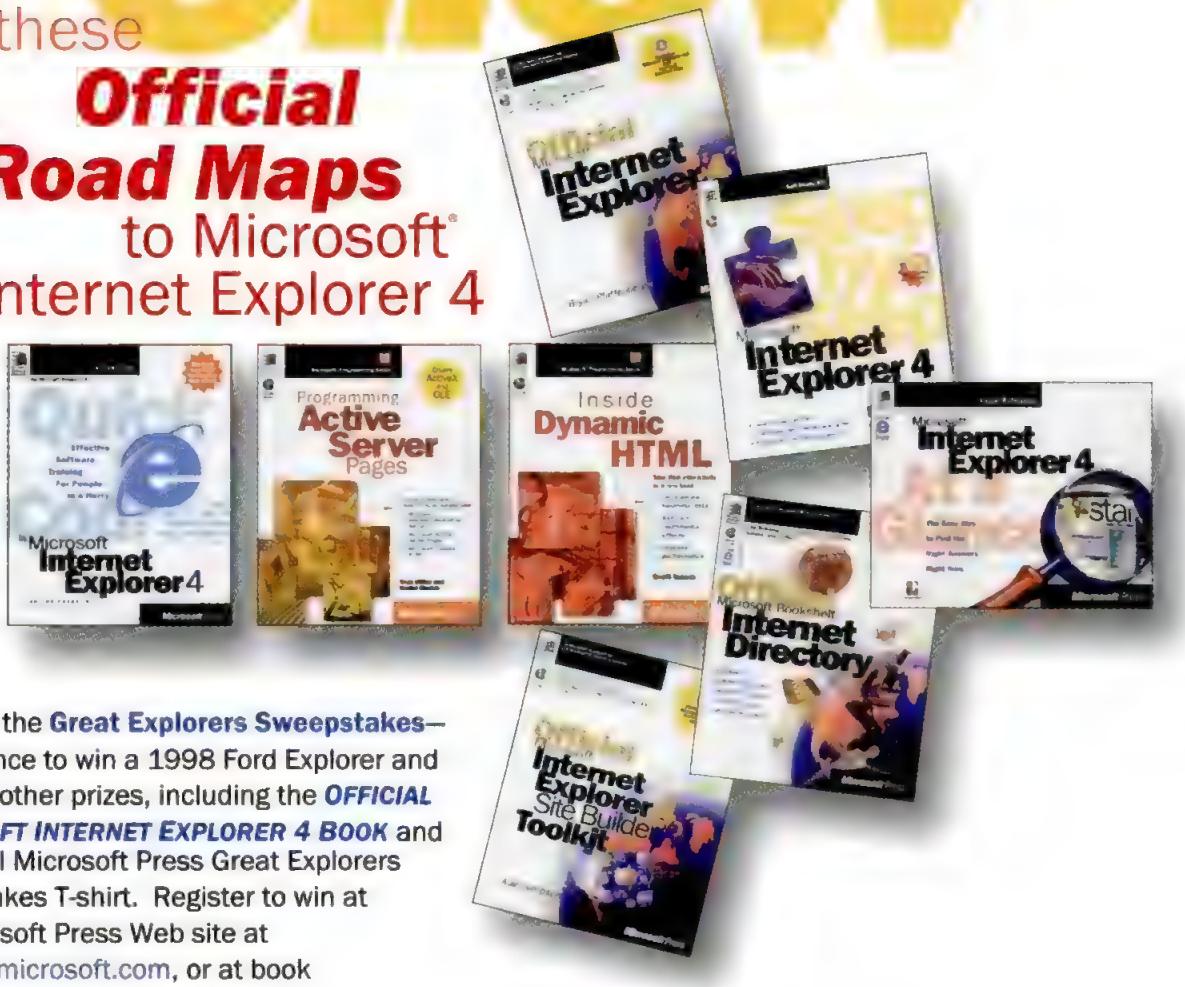

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OPEN FOR BUSINESS

WEB STOREFRONT CREATION SOFTWARE

After a slow start, business is picking up on the Web. These 12 products can help you hang your shingle online.

By David S. Linthicum

www.pcmag.com

Visit *PC Magazine*'s Web site for additional product reviews and links to top commerce sites built using these new products.

Bought anything on the Web lately? For most of us, the answer would still be no. But that may not be the case for long. Electronic commerce—the selling and buying of goods over the Internet—is now growing at a steady pace. While Web transactions still make up only a small percentage of retail sales today, businesses seeking to take the lead in their markets are establishing storefronts on the Web. Some are even making money.

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ILLUSTRATIONS BY CHRIS SHARP

The Elements of a Web Storefront

One of the reasons Web commerce has been slow to evolve up to now is that Web stores use many components that must all work together seamlessly. Tying these components together can be difficult, although the software packages we review have made strides in simplifying this process.

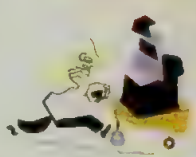
WEB SERVER

All Web storefront programs or commerce servers sit on top of existing Web servers. Most of the products we review run under Microsoft Windows NT with server software from Microsoft or Netscape, among others. ICentral's ShopSite Manager currently runs under Unix only, but a Windows NT version should be available soon. Entry-level products are designed to build sites hosted by the vendor or an ISP, eliminating the need to install or administer a Web server locally.

CATALOG BUILDER/ STORE ADMINISTRATOR

Web storefront creation packages allow you to generate HTML-based product catalogs using information from a product database. The more powerful packages can import product data from an Excel spreadsheet or database file; entry-level packages typically require you to enter this information manually. The better programs also make it easy to manage items that come in a variety of sizes, shapes, or colors. Once you've created the catalog, you'll also want administration features, such as the ability to create promotions for certain items.

DATABASE SERVER



Most Web stores typically have at least two types of databases: a product database and a customer database. The more powerful programs allow you to import existing databases using native SQL or DB2 drivers, or via ODBC. Customer databases include demographic information gathered from registered users via CGI scripts.

SHOPPING CARTS

Virtual shopping carts enhance the shopping experience by allowing customers to select items for purchase and continue browsing the store—or even leave the store and return later—before placing an order.

ORDER PROCESSING

Order processing involves several tasks, such as calculating taxes and shipping costs, and processing payments. Some products integrate these functions; others rely on third-party components such as Taxware for calculating state and local taxes and CyberCash for credit card verification. Security is also an issue, and many products implement SSL (Secure Sockets Layer) or S-HTTP for securing transactions over the Web.

To help businesses open their online doors, a new class of products has emerged. These products, known as Web storefront creation packages or commerce servers, work with existing Web servers, allowing visitors to register, log on, browse products, place products in virtual shopping carts, and purchase the goods or services securely. Most provide wizards or libraries of sample storefronts, as well as authoring tools, to help developers build the site quickly.

Behind this storefront, a lot goes on as well. Storefront creation packages should tie in to legacy applications, provide tools for calculating taxes and shipping costs, work with a variety of payment schemes, and process transactions securely. Finally, most provide site analysis and reporting tools for monitoring your site's progress.

Clearly, commerce software faces a complex challenge, and it's no surprise that the category is still developing. Most of the early adopters have been large companies. According to a Forrester Report, the majority (80 percent) of these spent more than $100,000 each to cobble together first-generation sites using a variety of tools. Fortunately, that's beginning to change. We found a dozen entry-level and midrange packages designed to help small or medium-size retail businesses set up shop on the Web. Although they vary widely in terms of features and price, all these programs allow you to build relatively sophisticated sites for a fraction of the cost of the earlier commerce sites.

THE MOM-AND-POP ONLINE SHOP

Each of the least expensive storefront creation programs is usually hosted by the vendor or a partner ISP and designed for small or medium-size businesses that want to establish a presence online with a minimum fuss. These entry-level products typically provide wizards that walk you through the process of setting up a storefront and then generate the site automatically—so you don't even need to know HTML, let alone programming languages such as Java or Visual Basic.

Two products in our roundup, Cartalog 4.0 from Virtual Spin and Viaweb Store 3.0 from Viaweb, aren't even software packages per se but rather are services that enable you to build a store online within your browser. Alternatives to these online services at similar prices include Forman Interactive's Internet Creator 4.0 and Peachtree Software's PeachLink, which integrates with Peachtree Complete Accounting. (Peachtree is planning to include PeachLink with the next version of Peachtree Accounting.)

Despite their simplistic approaches, most entry-level packages allow you to insert HTML—or graphics and multimedia files—into existing pages to customize your site as business grows. And they are relatively inexpensive. The fee for site hosting is based on the number of items in your store, and these entry-level products all start at less than $100 per month.

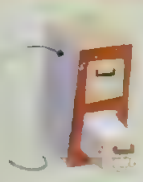
BIGGER BUSINESS

In the midrange category, we review Cat@log Builder 2.0 from The Vision Factory, Electronic Commerce Suite 3.0 from iCat Corp., Intershop Online 2.0 from Intershop Communications, Lotus Domino.Merchant 1.1, Merchant Builder 2.1 from The Internet Factory, Microsoft Site Server 2.0 Enterprise Edition, Net.Commerce 2.0 from IBM Corp., and ShopSite Manager from ICentral. Except for ShopSite Manager, which is currently Unix-only, these packages run under Microsoft Windows NT as well and are typically

SITE ANALYSIS/REPORTING

At the very least, all Web storefront creation packages should offer the same basic site analysis tools found in Web server software for reporting the number of page hits. More sophisticated packages allow you to generate detailed reports on sales and customers. Products that use standard databases have an advantage here, because you can use full-featured report writers such as Seagate Software's Crystal Reports to extract more information and produce polished reports.

LINKS TO LEGACY SYSTEMS



One of toughest challenges of Web commerce is linking your site to legacy applications, such as your inventory and accounting systems. Some midrange packages offer open APIs for developing links, but this remains one of the more costly aspects of setting up a Web storefront.

designed for larger businesses that host their own Web site. (We tested the Windows NT versions.) These products range in price from roughly $500 to $10,000. In the sidebar "Big-Business E-Commerce," we examine more costly solutions from Actra/Netscape, BroadVision, and Open market.

To test these entry-level and midrange storefront packages, we built a fictional clothing store and stocked it with a variety of products in different sizes and colors. Once the store was set up, we then initiated a series of transactions of varying complexity to test the customer experience.

The storefront creation packages we tested all need to store the product data someplace, and that place is typically a relational database. All of the midrange products except Microsoft Site Server include relational databases. For example, Intershop Online comes with Sybase 11, and IBM's Net.Commerce includes a scaled-down version of DB2. With the browser-based products (Cartalog and Viaweb Store), database support was less of an issue, since most products are already set up to use a database at the hosting site.

The midrange products also provide links to other databases through ODBC. This lets developers connect storefronts to existing databases. All of our midrange products support ODBC; IBM, however, would guarantee only that its ODBC subsystem will work with DB2 and Oracle.

On our tests, importing the data for our test store proved to be the biggest stumbling block for most products. While all of the packages provided some mechanism to import data from open formats (comma-delimited, tab-delimited, and so forth), they all had to massage the data to fit into their schemas, and problems such as data corruption were not uncommon. Among the midrange products, Net.Commerce proved the most difficult. We were forced to write the data out to a proprietary "loading" format before importing.

Some of the entry-level packages simply could not complete that portion of our tests. Viaweb Store, for instance, has no provision for uploading existing data files. Of course, the vendor will attach the data for you at the back end, but you run the risk of violating data integrity rules, which could cause erroneous results. And vendor-hosted products typically don't provide you with direct access to the resulting databases.

Once you have that data in your store, the next step is to figure out how to show it to the world. The products in our roundup offer a variety of authoring tools ranging from run-of-the-mill to radical. Microsoft Site Server, for example, bundles the powerful Visual InterDev; by contrast, Intershop Online's script editor leaves a lot to be desired, and Merchant Builder requires knowledge of HTML and a lot of time.

Editors' Choice

- Web start-ups: Viaweb Store 3.0
- Bigger business: iCat Electronic Commerce Suite 3.0

PC MAGAZINE EDITORS' CHOICE

In electronic commerce, one size does not fit all.

Large businesses can spend hundreds of thousands to construct commerce sites, but there's room for all types of businesses, as our Editors' Choice products demonstrate.

Our choice for those just getting started with Web commerce, Viaweb Store, allows small businesses or those just venturing online to build entire storefronts through their Web browsers—and for a very nice price. To create a store with Viaweb, the only things you need are your browser and an Internet connection. But Viaweb's simplicity belies its sophistication: Its editing, publishing, and reporting features rival those of many midrange products we tested. Go to *www.viaweb.com* and try it yourself for free.

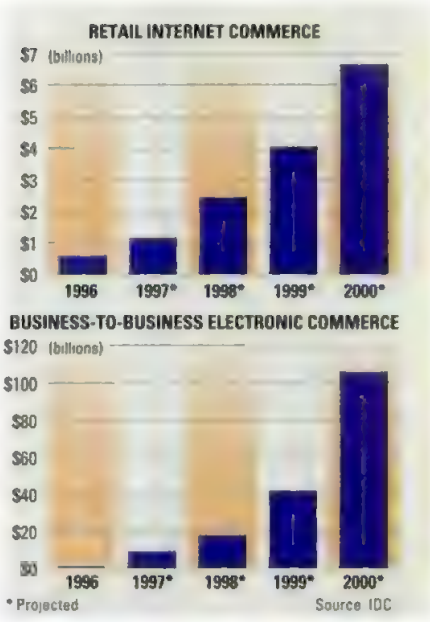
Further up the e-commerce scale is our Editors' Choice for larger businesses: iCat's Electronic Commerce Suite 3.0, Professional Edition. A more robust solution suitable for any size business, it has some formidable competitors. Nevertheless, this mature e-commerce solution is up to the challenge. Electronic Commerce Suite includes the best selection of storefront templates. New to this version are ODBC support, remote site administration via a browser, and Sybase's SQL Anywhere database. All that adds up to a commerce solution that means business.

Our Contributors: DAVID S. LINTHICUM is a frequent contributor and electronic commerce expert with Ernst and Young's Center for Technology Enablement. HEATH H. HEREL and DAWN A. LEARNED are freelance writers and computer consultants for Walker Systems Support, based in New Britain, Connecticut. STEVE BUEHLER is the director of PC Magazine Labs, West Coast. SEAN GONZALEZ is a freelance writer. DIANE JECKER was the project leader, and JOHN MORRIS was the associate editor in charge of this story.

At the low end, Viaweb provides powerful WYSIWYG, browser-based page editing. Most servers support open scripting standards such as JavaScript and VBScript, but some, such as iCat's Electronic Commerce Suite, offer only proprietary scripting languages. However, Electronic Commerce Suite also comes with the best selection of templates (or "layouts," as they're called in the product), allowing you to get up and running quickly.

Most of the storefront creation packages integrate with third-party components for tasks like calculating taxes (Taxware) and processing payments (using systems such as CyberCash). The midrange programs also allow you to access legacy systems through APIs (application programming interfaces) so that you can, for example, link the inventory database to your enterprise accounting system. The entry-level products are designed for smaller businesses and do not include open APIs.

Of course, once you have your store running properly, you have to mind it, and this is where site analysis and reporting tools come in. Most midrange storefront creation packages provide "sales by" reports, such as sales by member, sales by date range, and sales by product. Commerce Suite offers the greatest number of reports, while Microsoft provides the most sophisticated site analysis tools. Since most of the midrange systems use standard databases, you also have the option of using third-party reporting tools such as Seagate Software's Crystal Reports and Borland's Report Smith. The entry-level products, on the other hand, tend to be very limited in these areas.



COMPARISON SHOPPING

With so many options, what should you look for in a storefront creation package? During our testing, a few important qualities emerged. First, while most of these products were relatively easy to install and made short work of basic sites, creating a customized store took a little more effort. We advise you not to try to do it from scratch. Pick a product such as Electronic Commerce Suite or Net.Commerce, which offers a wide variety of sample stores to build from.

Second, don't discount the entry-level packages, especially if you have a small retail business. If you can live without robust database connectivity and extensive reporting tools, you'll find that many of the entry-level products are capable of producing slick sites with a minimum of effort and at little cost.

The road to electronic commerce is not yet paved with gold. All of these products need a few more cycles before they can offer what we consider true turnkey commerce solutions. But with Web commerce set to explode in the coming years, electronic commerce software should evolve rapidly. And if you're adventuresome, the tools you need to help you get a jump on the competition are already here.

GLOSSARY

Terms of Business on the Web

Certification authority (CA) A secure third-party organization that can verify the identity and origin of a person or component (such as ActiveX controls) VeriSign is the leading CA.

CyberCash An integrated electronic-payment system developed by CyberCash Inc.; used by commerce servers to verify credit cards and process payments.

Digital signatures Electronically coded messages that accompany text messages, identifying the author of each document or component. For example, all ActiveX controls transmitted over the Web are digitally signed by their creators.

Electronic wallet Also called a virtual wallet; a software mechanism that allows commerce server users to store and use credit card and electronic payment information. Typically, information in the wallet is encrypted and is persistent from session to session

Internet Keyed Payment (IKP) A group of secure payment protocols created by IBM that let customers purchase goods and services securely over the Web

Joint Electronic Payment Initiative (JEPI) An Internet payment standard proposed by CommerceNet and the W3 Consortium. It focuses on data security and interoperability between payment schemes

Public-key encryption An encryption system that uses two keys, a public key for encrypting messages and a private key for decrypting messages, to enable users to verify each other's messages without exchanging secret keys

Secure Electronic Transaction (SET) A secure payment protocol developed by MasterCard and Visa designed to ensure security for bank card transactions over the Internet. It denies merchants access to credit card information, thus keeping it secure between the shopper and the bank. It is expected to be finalized at the end of 1997

Secure HyperText Transfer Protocol (S-HTTP) A secure version of HTTP, developed by Netscape, that provides general transaction security services over the Web.

Secure Sockets Layer (SSL) A public security protocol, also developed by Netscape, that can create a secure link between the Web server and the browser.

SKU Stockkeeping unit; a number designating one specific product.

Taxware A software program, developed by Taxware International, that provides detailed tax rate information to commerce servers over the Internet.

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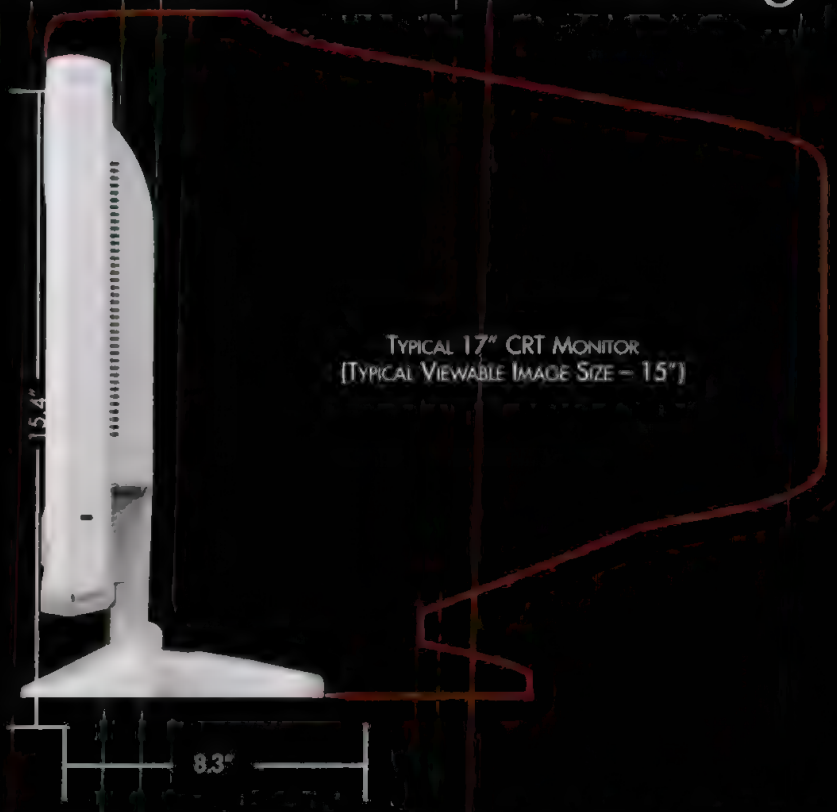

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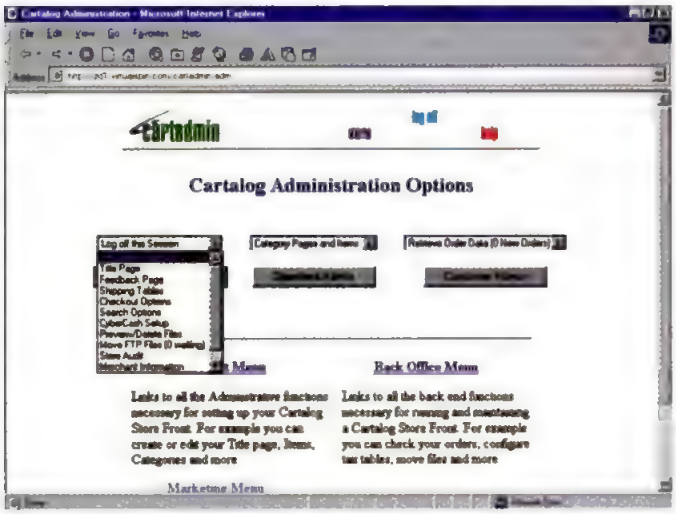
Virtual Spin LLC

Cartalog

A browser-based commerce solution, Virtual Spin LLC's Cartalog 4.0 is easy enough for novices to use while offering the flexibility and power that Web designers demand. As with Viaweb Store, you don't have to install any proprietary software; all you need is a browser and an Internet connection. Cartalog is also the most economical solution we reviewed; the vendor-hosted service starts at $50 (street) per month for up to 150 SKUs.



Cartalog's strong browser-based environment lets you build each piece of your site with a great deal of flexibility.

Creating your Cartalog site is quick and easy, with a series of wizards walking you through the process. You can enter HTML directly or import pages created using an external editor to customize your site further. If you find that the wizards don't provide the power you need, you can bypass them and design the site from the ground up without any assistance.

Cartalog's management tools are among the best in the bunch, with a friendly interface that lets you control every aspect of your site. Managing shipping requires little effort: A series of HTML forms takes you through the entire process and makes it easy to configure multiple shipping tables in just a few minutes. Sales tax is no more complicated: You can enter multiple rates and be as specific as necessary. Adding graphics to your site is amazingly simple. You can upload graphics (provided that your browser supports this ability) or select from a massive library of GIFs on the Virtual Spin server.

Setting up your site to use CyberCash is easier with Cartalog than with any other product. Its unique approach provides direct access to all CyberCash management functions from your site's management interface.

The reporting features are very easy to use, but Cartalog didn't offer the breadth of reports found in midrange products or even in a direct competitor such as Viaweb Store. Cartalog does provide activity levels for various time increments (days, weeks, months), successful hits per page, frequency of hits by IP address and browser, and referral information. The quality of these reports is unsurpassed, but they lack some of the information (such as spending trends) found in the other products. Also, the reports are not currently available in real time; they must be run as scheduled jobs. The company's tech support will supply other reports at any time.

Cartalog distinguishes itself from other vendor-hosted products by allowing merchants to host their own sites at a reduced rate. ISPs wishing to provide e-commerce to their clients can also obtain the Cartalog software and immediately gain a powerful commerce solution. Virtual Spin sets up the software for you and provides routine updates and maintenance as part of the agreement, which reduces much of the workload involved in hosting your own site.

Cartalog is a cost-effective way to put your business online quickly—without losing the ability to enhance the site or even host it yourself as your business grows. We gave Viaweb Store the edge in this category because its reporting tools are a bit stronger, but Cartalog is an impressive package that deserves serious consideration.—*Heath H. Herel*

Cartalog 4.0. Street price: 150 SKUs, $50 per month. Requires: Web browser, Internet connection. Virtual Spin LLC, Bellevue, WA; 888-853-5600, 206-974-1100; fax, 206-974-1200; www.virtualspin.com. *Circle 461 on reader service card.*

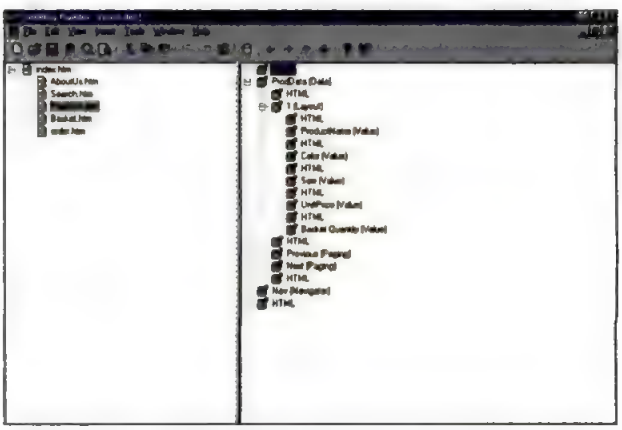
The Vision Factory Inc.

Cat@log Builder

Harnessing the power of electronic commerce can be tricky without the right tools, but The Vision Factory has provided all the requisite power in its latest release of Cat@log Builder. Like The Internet Factory's Merchant Builder, Cat@log Builder 2.0 is designed to work in conjunction with your Web server, providing support for ISAPI and CGI.

Unlike the other products in this roundup, Cat@log Builder ($4,995 list) is not merely a wizard-based GUI tool. Rather, it is a full-fledged development tool for creating an e-commerce site. Novice users should approach it with caution, but power users and developers will feel instantly comfortable and relish the power it provides.

Cat@log Builder does not offer an integrated authoring tool. You must select external tools for authoring, and you can choose both a WYSIWYG editor such as Microsoft FrontPage and a text editor. Cat@log Builder's IDE (integrated development environment) is strictly hierarchical, letting you view every aspect of your site, and you can drill down into any piece



Cat@log Builder's IDE (integrated development environment) gives Web developers a powerful tool to add commerce to any site.

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Average seek time

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STEVE JORDAHL

IS Analyst and Developer

McDonnell Douglas

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Average seek time

10ms read/12ms write

Maximum sustained transfer rate

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of it for easy viewing and editing.

You can give your site e-commerce a variety of features by using components that can be easily inserted into HTML pages. The components range from the shopping basket and ordering functions to a full-featured search capability. What makes this approach truly powerful is that any component can be placed on any Web page. A series of wizards makes adding and customizing your components fairly painless.

You can also connect to any data source via ODBC and add a data component to your site that can read from the data source at runtime and give your customers an up-to-date list of your product lines. The query component builds on the ODBC connection to create a powerful search engine for your entire database. Because the components reside within HTML, they can be customized with your editor.

More advanced components let you create variables that can display user-provided information or call external programs for greater functionality. Since Cat@log Builder is completely extensible, you can build your own components to add new functionality.

Cat@log Builder's component model can also support critical e-commerce functions. For example, shipping and sales tax calculations, as well as support for CyberCash and First Virtual, require additional components. For taxes and shipping costs, you must build the tables separately and then connect them with the components. The process is not very intuitive, but the documentation does an admirable job of guiding you along.

Statistics are reported through a log file that tracks hits for every page in your site. Cat@log Builder also provides statistical tracking for all queries run against your data source, detailing which ones were run and providing a counter for each. A similar mechanism tracks each component in your site. Cat@log Builder also lets you aggregate a statistics file and export it to a Microsoft Excel spreadsheet template.

Cat@log Builder is not the product to choose if you want to open your virtual shopping doors immediately. But its component-based approach provides maximum flexibility and should appeal to developers seeking to expand their commerce toolkits.—*HHH*

Cat@log Builder 2.0. List price: $4,995. Requires: 486-based PC or better, 32MB RAM, 2MB hard disk space, Microsoft Windows 95 or NT. The Vision Factory Inc., Scotts Valley, CA; 888-488-3228, 408-461-2100; fax, 408-461-9255; www.thevisionfactory.com. *Circle 462 on reader service card.*

SUITABILITY TO TASK: WEB STOREFRONT CREATION SOFTWARE

WEB START-UPS
LARGER BUSINESSES

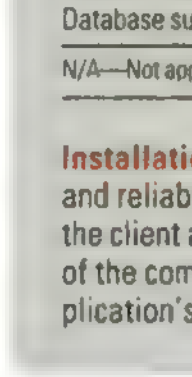
Power	Cartalog 4.0	Internet Creator 4.0	PeachLink	Viaweb Store 3.0
Installation and administration	Excellent	Good	Good	Excellent
Design and publishing tools	Good	Fair	Fair	Good
Order processing	Good	Fair	Fair	Good
Reporting	Fair	Poor	Fair	Excellent
Database support	N/A	N/A	Fair	N/A
Ease				
Installation and administration	Excellent	Excellent	Excellent	Excellent
Design and publishing tools	Good	Excellent	Excellent	Excellent
Order processing	Excellent	Good	Good	Good
Reporting	Excellent	Good	Good	Excellent
Database support	N/A	N/A	Fair	N/A

N/A—Not applicable: The product does not have this feature

Installation and administration refers to the ease and reliability of the software's installation on both the client and server (if applicable), the maintenance of the commerce site, and the robustness of the application's remote capabilities. **Design and publishing tools** reflects the product's flexibility and strength in setting up the electronic commerce data, editing to HTML, searching for catalog items, and generating creative sales promotions. For **order processing** we evaluated the ordering system as a

iCat Corp.

Electronic Commerce Suite



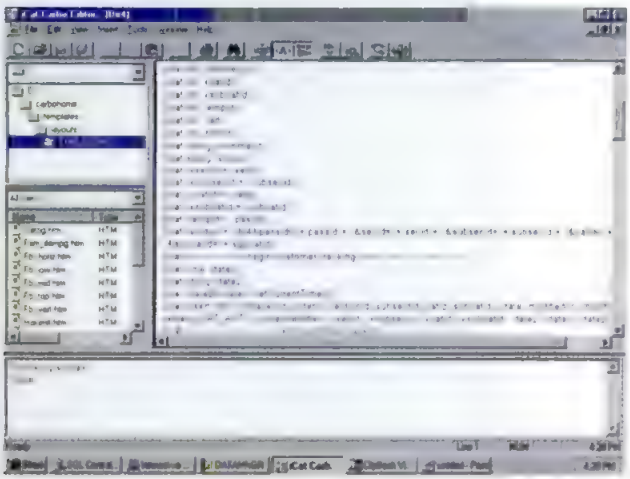
One of the more mature and feature-rich products we tested, Electronic Commerce Suite 3.0, from iCat Corp., comes in two flavors targeted at distinct e-commerce site developers. The Professional Edition ($9,995 list), which we tested, packs all the features you'll need to design, deploy, and manage multiple commerce sites on either Windows NT or Unix servers—perfect for ISPs and large retail organizations. The Standard Edition ($3,495 list), which runs on Windows NT only, provides just enough features for small or medium-size outfits.

A marked improvement over the previous version, Commerce Suite 3.0 includes remote administration via a browser, ODBC support, and Sybase's SQL Anywhere relational database engine. We would have preferred an open scripting solution rather than a proprietary language and a built-in inventory control feature. But otherwise, Commerce Suite is an excellent e-commerce solution.

Commerce Suite provides a slew of layout templates that let you create both canned and custom sites quickly. The templates provide such catalog creation features as indexing, searching, a shopping cart, user registration, user tracking, and sales management. Users can snap one into the system as is or modify it using an HTML editor and Carbo, Commerce Suite's proprietary scripting language. Each template supports different payment-processing methods (such as Checkfree, CyberCash, Open Market, or SSL) for transaction security. Although the templates make it extremely easy to place products on sale or provide discounts for special customers, oddly absent was one for checking inventory of available stock.

Cat@log Builder 2.0	Electronic Commerce Suite 3.0	Intershop Online 2.0	Lotus Domino.Merchant 1.1	Merchant Builder 2.1	Microsoft Site Server 2.0	Net.Commerce 2.0	ShopSite Manager 3.1
Excellent	Good	Good	Good	Excellent	Excellent	Good	Good
Excellent	Excellent	Fair	Good	Good	Good	Fair	Fair
Good	Good	Good	Good	Good	Good	Fair	Poor
Good	Good	Fair	N/A	Good	Good	Fair	Poor
Good	Good	Good	Good	Good	Good	Fair	N/A
Good	Good	Good	Good	Good	Excellent	Good	Fair
Good	Excellent	Fair	Good	Good	Good	Fair	Excellent
Fair	Excellent	Good	Good	Good	Good	Fair	Good
Fair	Good	Fair	N/A	Good	Good	Fair	Good
Fair	Good	Good	Good	Fair	Good	Fair	N/A

whole, including the shopping metaphor, calculation of taxes and shipping costs, credit card integration, security, order confirmation, notification, and tracking. **Reporting** refers to the product's ability to provide the merchant with the data necessary to maintain a commerce site in a satisfactory manner; such data can include customer statistics, invoice processing, shipment tracking, sales reports, inventory reports, purchasing/supplier tracking, and customer buying trends. In that category, we also examine how well the data exports to other applications. **Database support** reflects the product's ability to integrate with the merchant's legacy systems, which may include ODBC support, accounting systems, inventory control, and customer information.



iCat's Electronic Commerce Suite includes a proprietary scripting language called Carbo for customizing your site.

Commerce Suite also includes a database for your product information that provides you with most of the data attributes you need to collect, as well associated business and integrity rules. Importing data via the Data Entry Manager was quick and easy, though we had to manipulate the data before it fit into the database's fixed schema. Data Entry Manager also lets you store, organize, format, search, sort, and report on the data.

If your site requires customization or additional functionality (such as inventory checking), you'll need to learn Carbo. Since the code is not usable with different platforms, this is Commerce Suite's biggest limitation. Other products we tested use open languages, such as JavaScript and VBScript, for customization.

We designed most of our test store using Commerce Publisher. It let us create and define catalogs, enter and edit data, manage templates, publish catalogs, and review sales information using any layout and plug-in templates. The tax, shipping, and payment options are completely customizable (without using Carbo), and a trial edition of Taxware software is included for more advanced tax calculation capabilities.

The reporting functions are in the Sales Manager module, which has tools for tracking and analyzing sales data. It also lets shoppers review the status of an order and even view their order histories. This feature comes with the base product and can be found in the sample store.

In view of the price, you need to be serious about expanding your business onto the Web. But if you are, iCat's Commerce Suite has the ability to get you up and running quickly and the power to grow with your business.—*David S. Linthicum*

Electronic Commerce Suite 3.0. List price: Professional Edition, $9,995. Requires: 486-based PC or better, 16MB RAM (24MB for Windows NT), 60MB hard disk space, Microsoft Windows 95 or NT 4.0. iCat Corp., Seattle; 888-553-8800, 206-505-8800; www.icat.com. *Circle 463 on reader service card.*

Forman Interactive Corp.

Internet Creator

More like a Web-site authoring environment than an e-commerce tool, Forman Interactive Corp.'s Internet Creator 4.0 ($149 list) enabled us to create a Web

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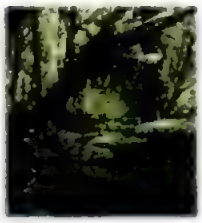

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Online Services and ISPs Get Down to Business

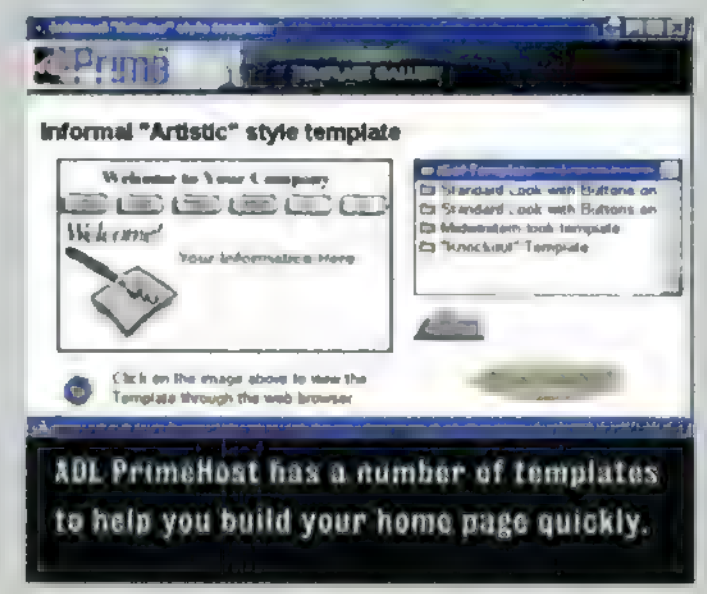
If you want to establish a Web storefront but don't want to go it alone, your ISP can probably help. Major online services and most ISPs offer Web hosting and site-building services and tools. These solutions range from wizards and templates that let you build basic HTML pages quite effortlessly to hosting services that help you launch and manage an e-commerce storefront.

Service providers tend to segment their e-commerce options into two markets: novice or intermediate Web site designers versus experts. Content development tools—including wizards, templates, and WYSIWYG HTML editors—and stock forms and CGI scripts make up the typical toolkit targeted for novice and intermediate Web site designers.

Expert Web site designers are usually less concerned about content development tools and more interested in functionality options and the flexibility to implement the features they need. Some common service options that fall under this category include Internet domain name support, Web site traffic analysis tools, and e-commerce support options. And in case you already have a Web server but do not have or want to deploy and support an Internet connection, ISPs have co-location and shared Web server options to relieve you of that burden.

Although you can use AOL's Personal Publisher II—a free service to all AOL users—to build a basic Web site, AOL's PrimeHost services (*www.primehost.com*) are what you'll need if you are interested in e-commerce. PrimeHost Domain ($149 startup fee for AOL members, $249 startup fee for non-AOL members; $99 per month, plus $100 for the two-year registration fee) gives your company its own Internet domain name, 5,000 pages with graphics and 150,000 hits per month, content-building templates, and AOLPress, a WYSIWYG HTML content editor. PrimeHost Commercial ($149 startup fee for AOL members, $249 startup fee for non-AOL members; $199 per month, plus $100 for the two-year registration fee) includes 100MB of disk space, a 3GB transfer limit per month, FTP support, CGI support, and AOLserver's Tcl API. Finally, PrimeHost Commercial with Storefront (an upgrade from Prime Host Commercial costing an additional $300 for setup and $50 per month) includes unlimited batched credit card transactions (with live transaction processing coming soon), SSL encryption, and a shopping cart.

Leveraging each of its divisions' strengths, CompuServe also offers multiple Web hosting services to meet your needs. Csi BusinessWeb (*businessweb.csi.com*) targets home-based and small or medium-size businesses. Using NetObjects' Fusion (*www.netobjects.com*) and Windows NT IIS–based servers, Csi has developed a content creation and update process that is easy to use and lets you test your content on a staging server before publishing it on the Web. This $79-per-month service offering ($50 setup fee) includes 30MB of content and a 1GB transfer limit per month. Csi also plans to deploy a new e-commerce solution.



For medium to large businesses, CompuServe Network Services (*www.networks.compuserve.com*) offers dedicated Unix servers starting at $1,500. These servers run Netscape Enterprise Server and support Microsoft FrontPage extensions to help you manage your content. Although this service will meet the hosting needs of most businesses and rid you of server headaches, building your e-commerce site is up to you.

Prodigy's Web hosting service ProHost (*www.prohost.net*) includes 200MB of content and 1GB transfer limit per month. ProHost has a $1,400 minimum startup fee; service charges start at $1,400 per month. As with CSi BusinessWeb, you upload your content to a staging server; however, content is updated automatically on an hourly basis by default. But ProHost is not a turnkey solution.

Compared with the online services, ISPs do not focus as much on the site development. Instead, they excel at co-location and shared-server services, providing the stable hosting environment required to ensure that your business stays open 24 hours a day on the Web.

Some ISPs go beyond server colocation and shared-server offerings to give you tools to build and support an e-commerce Web site. As an example, Uunet has good service offerings. It offers SSL encryption and a way to handle secure back-end transactions using its credit card transaction system. Uunet also provides scripts to help you encrypt credit card information using PGP (Pretty Good Privacy) whenever it needs to be stored locally on a server. Besides encryption, Uunet also runs a CyberCash server and has set up a proxy server to handle all CyberCash management transactions.

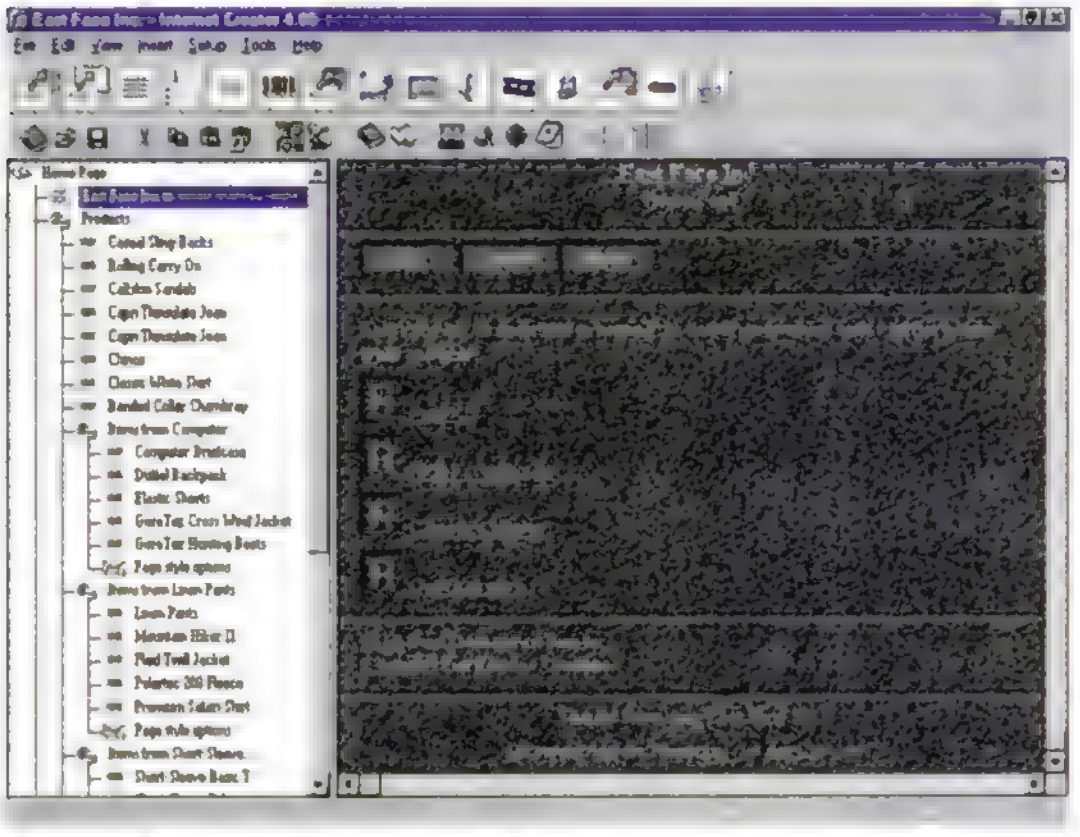
To help you build and maintain your content, Uunet supports ColdFusion (*www.coldfusion.com*), Microsoft FrontPage extensions, and the Microsoft Content Replication Service (CRS). Uunet supports Microsoft Index Server and IIS and has BSDI Unix servers available as well. Uunet's commerce services range in price from $300 to over $3,000.

Of course, Uunet is not the only ISP that offers a strong e-commerce solution. We recommend that you look for an ISP that offers a comprehensive solution.

Smaller businesses, or those with limited commerce requirements, will be best served by the online services, because the online services offer easy-to-use tools for building sites, as well as hosting facilities. Larger businesses will find the security, reliability, and payment processing options of ISPs such as Uunet to be more attractive.—*Sean Gonzalez*

site—complete with company information, shipping tables, ordering forms, and more—in under an hour. Like most entry-level authoring tools, Internet Creator is easy to use and tailored to those who want to build a site quickly.

Internet Creator's well-designed wizards allow even novices to create fully functional Web sites. All you need to do is enter some basic information about your company; Internet Creator generates the database and a series of pages automatically. All work on your site is done through the proprietary software locally, so you can experiment without affecting your live storefront. While products such as Merchant Builder and Viaweb Store also provide a staging area, Internet Creator truly allows you to work off-line with or without a browser.



Internet Creator has an Explorer-like authoring environment that displays the site's structure.

The program's commerce features are handled by a wizard. The Commerce Wizard helps you set up credit card information, create shipping tables, and customize the ordering process. Once you've run all the wizards, you've created the basic elements of your site.

Expanding your site is just as easy. Internet Creator provides numerous GUI tools to create additional Web pages without writing HTML. You can quickly insert any element into a page or create a new page with just a few mouse clicks. Internet Creator even facilitates the process of embedding Java applets into your pages.

Internet Creator lets you add new items to your store manually or import them from a variety of formats into the program's database system. It also provides a number of stock fields for your store, which you can extend to meet your needs. If an item has several options—sizes or colors, for example—you can add them easily. These options are all stored within the single transaction item, so you don't need to enter separate SKUs to account for the various options. Your customers will see the options listed in a drop-down box, enhancing the end-user experience.

Like most vendors in this category, Forman Interactive will host the site for you. Company-provided server space at *www.register.com* hooks your site to all the back-office functionality it requires. Publishing your site to the hot link is even easier than building it: An upload wizard eases the process by handling FTP behind the scenes. As you make changes locally, Internet Creator tracks which pages have changed and offers to upload incremental changes only.

Forman Interactive's Merchant Management System (MMS) supplies site management tools that are accessible through your browser. The MMS tools let you generate site reports, maintain mailing lists and access control, and manage your CyberCash account.

With its wizard-driven approach, Internet Creator is one of the easiest and fastest ways to put your business online without taking a crash course in HTML.—*HHH*

Internet Creator 4.0. List price: $149; hosting, $19 per month; with separate domain name, $29 per month. Requires: 486-based PC or better, 8MB RAM, 10MB hard disk space, Microsoft Windows 95, 3.*x*, or NT 4.0. Forman Interactive Corp., Brooklyn, NY; 718-522-2260; fax, 718-522-0267; www.forman.com. *Circle 464 on reader service card.*

Intershop Communications

Intershop Online

One of the easiest commerce servers to get up and running, Intershop Online 2.0, from Intershop Communications, provides excellent data management features through easy-to-use subsystems. But to realize all the functionality, you have to apply several patches. We also had considerable difficulty customizing it for our tests.

Like iCat Corp.'s Electronic Commerce Suite, Intershop comes in two versions: Intershop Online ($4,995) and Intershop Mall ($7,995). Intershop Online (the version we tested) includes a single-store license; Intershop Mall comes with a five-store license and lets you add more storage. Intershop Mall also has administration features that let site owners open and close stores as needed. Both versions are available for Windows NT and Unix, but the Unix version is almost double the price.

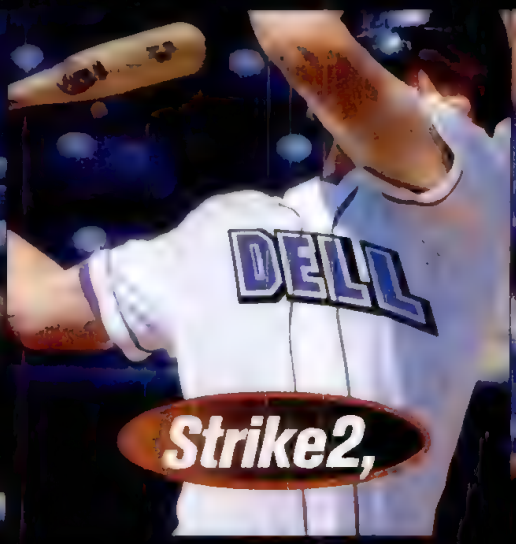
Solid database support comes from Sybase SQL Server 11, bundled with the product. ODBC support also lets you use most other relational databases, including DB2, Informix, and Oracle. Intershop Mall provides a separate database for each store, which prevents any potential problems that might stem from pooling data from multiple stores in one place.

As with many products, importing our test data to the catalog was problematic.

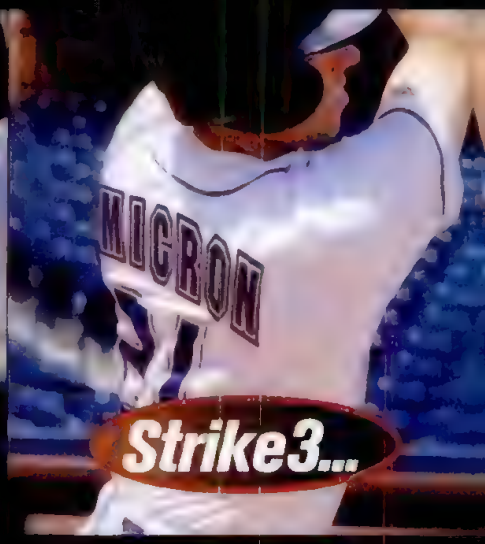
Intershop Online comes bundled with Sybase SQL Server 11 for storage and management of product data.

HEY, GATEWAY, DELL & MICRON...

Strike 1,



Strike 2,



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-Computer Shopper, Oct. '97

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Okay, so maybe it had a little bit to do with it. But the big news here is that with our new SuperDisk™ Drive, you can access 120MB of storage, up to five times as fast as standard floppies. And here's the kicker, it still works with 1.44MB diskettes. Just plug it into your PC's parallel port. Or look for SuperDisk LS-120 drives built into new PCs. To make more room, call 1.800.888.1889, ext. 3001 or surf www.imation.com.

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Passing the Buck Online

No matter how good your business's site is, it won't directly help the bottom line much unless you have a means of making money. A variety of transaction systems are now in place, and all of the products we review in our main story—with the exception of Peachtree's PeachLink—support at least one method of processing payments. These products allow you to accept payments electronically in a manner that is both secure and nearly invisible to your customers. Choosing the payment type that is right for your product or service and ensuring the security of your site are as critical to the success of your e-commerce venture as is the quality of your products and your marketing efforts.

Credit card payments are best suited for one-time purchases (for example, purchases of hard or electronic goods). Companies like CyberSource (*www.cybersource.com*) and First Virtual (*www.fv.com*) process the credit card transactions for you, while products like ICVerify (*www.icverify.com*) require you to use a dedicated link from your system to the credit card company to settle your transactions directly.

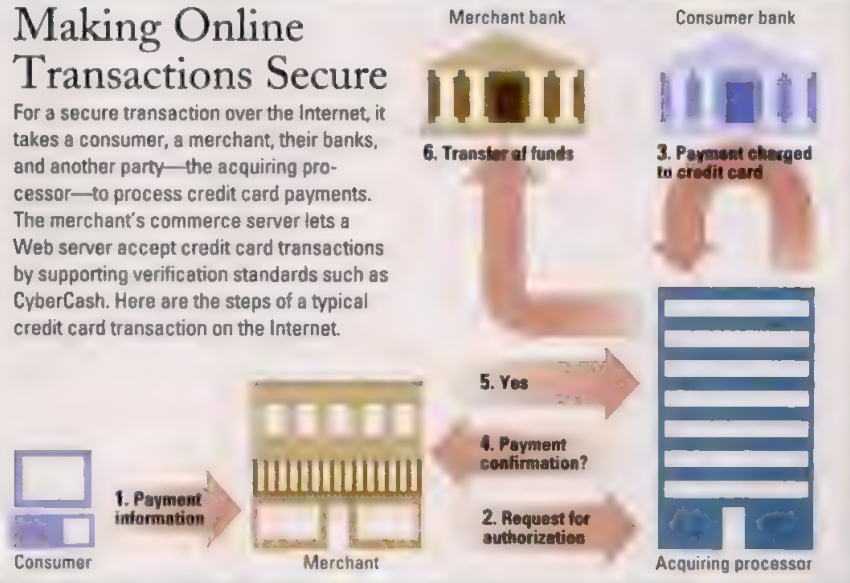
Check payments are often used to pay bills or make recurring fixed payments. Both CyberCash (*www.cybercash.com*) and CheckFree (*www.checkfree.com*) require an end-user subscription to use their service. These companies make electronic funds transfers (EFTs) from the end user's checking account to the vendor's account based on a schedule or a per-transaction request. InfoDial's Internet Checks, part of the company's Cashier 3.0 transaction system, lets customers authorize merchants to print checks for purchases made online (*www.infodial.net*).

DigiCash's ecash (*www.digicash.com*) is the Internet's closest equivalent to paper and coin currency. The end user withdraws funds from a bank account and converts them to ecash. Transactions using ecash are secure and anonymous, and they can take place between any two ecash users, including end users. However, only servers running the DigiCash server can convert ecash back to regular currency. Unfortunately, ecash is likely to remain nothing more than a great idea until more banks issue ecash currency.

Micropayment products, such as CyberCash's CyberCoin (*www.cybercash.com*) and Digital Equipment Corp.'s Millicent (*www.millicent.digital.com*), address the problem of handling very small payments for which credit cards, checks, and ecash would be unsuitable. Typical examples include fees for looking up information from a database or purchasing a magazine article online—transactions that would likely cost a few dollars, or even a few cents, and would be impractical without micropayments.

Making Online Transactions Secure

For a secure transaction over the Internet, it takes a consumer, a merchant, their banks, and another party—the acquiring processor—to process credit card payments. The merchant's commerce server lets a Web server accept credit card transactions by supporting verification standards such as CyberCash. Here are the steps of a typical credit card transaction on the Internet.



SECURING YOUR SITE

Although e-commerce is growing in popularity, consumers are still fearful of using the Internet to conduct money transactions. The fact is, e-commerce can be more secure, especially when credit card payments are involved.

Unfortunately, not all e-commerce sites implement security correctly: Even major sites such as Starwave have been exploited by people seeking to gain unauthorized access to credit card information. Whether you are building your own SSL-protected forms to capture credit card information or you are using a commercial e-commerce product, always make sure that credit card and other sensitive information is encrypted if it is stored in your local system. If your systems are compromised, at least the encrypted information—and your customers—will be protected.

Although electronic commerce is still terra incognita for many businesses, analysts agree that e-commerce is bound to happen—and that it's going to make vendors a lot of money.

As new e-commerce technologies and standards emerge, it's likely that you'll have to reengineer your site to use a different e-commerce solution. But keep in mind that being there first makes a big difference. The technology needed to conduct business safely and efficiently is available now. You may have a lot to gain by joining the bandwagon today.—*SG*

Choosing a quality color system

*Source: Dataquest, A Gartner Group Company

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3

[redacted] you to high quality, network-compatible color for your [redacted]. And you'll see how simple and productive network-compatible color can be with a Canon Color Laser Copier/Printer.

With the CLC 320 and a ColorPASS 320 Controller, for [redacted] users can easily produce continuous tone images up to 11" x 17" at 5 pages per minute.

The CLC 700 Series and CLC 800S simplify higher volume [redacted] with such productive features as a print speed of 7 pages per minute and a 2,050-sheet paper capacity.

[redacted] as Automatic Duplexing capabilities, the CLC 800S [redacted] the most complex network jobs quick and effortless.

What [redacted] whatever the network, whatever the source, however your [redacted], we can make the reality of Canon [redacted] a reality for your business. After all, we've been [redacted] in laser color in the U.S. for ten years.*

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Canon

CLC 800S

Our initial attempt corrupted the data, and even after reformatting, the test transactions refused to work. After some poking and prodding, we discovered that Intershop refused to accept spaces in product names (a point omitted in the documentation). On removing the spaces, we were able to complete the transactions without errors.

Before using Intershop, you need to make sure that you apply all the patches. Since these are available on the Intershop Web site, doing so is relatively simple. Other patches offer features developed after an early code freeze. Intershop's use of JavaScript for development and content delivery lends itself to robust customization. Some developers may prefer JavaScript to a proprietary scripting language such as iCat's Carbo.

Creating our test store using templates in the Catalog Manager was simple. The Catalog Manager made it easy to assign catalog and list templates to display product categories and product lists. Stock is controlled through the Product Manager, which lets you search, add, edit, or delete products.

The Store Manager allows viewing by transaction type and customer, and the Purchasing Manager was able to handle our fictional manufacturers and suppliers and reorder out-of-stock items, even sending the administrator an e-mail alert when a requested product was out of stock.

Inventory control is where Intershop stands out. The Inventory Manager tracks all stock changes, letting you view stock, enter products manually, or generate a list of inventory transactions. Intershop also includes extensive prebuilt inventory control features lacking in the competition. It logs all changes to inventory, products, and sales and even lets administrators roll transactions back or forward in the event of a hardware or software problem.

The back office features of Intershop were the best we tested, providing easy-to-use interfaces to do everything from gathering sales data to managing inventory. Missing was an API to let Intershop communicate with legacy applications; it is expected in the next release.—*DSL*

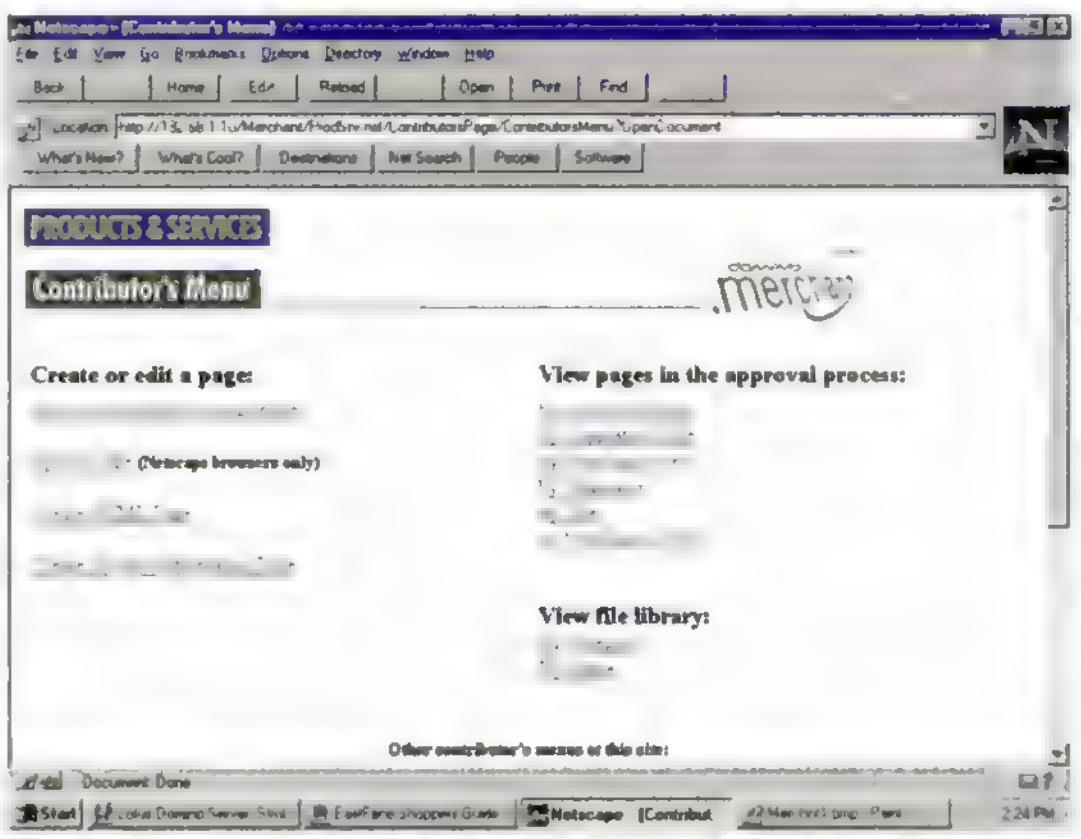
Intershop Online 2.0. List price: Microsoft Windows NT version, $4,995; Unix version, $7,995. Requires: Dual Pentium Pro–based PC or better, 64MB RAM, 300MB hard disk space, Microsoft Windows NT 3.51 or later. Intershop Communications, West San Francisco, CA; 415-581-0066; www.intershop.com. *Circle 465 on reader service card.*

Lotus Development Corp.

Lotus Domino.Merchant

If you already use Lotus Domino as your messaging/groupware system and you're ready to set up shop on the Web, Lotus Domino.Merchant 1.1 may provide the best e-commerce solution for you, because it integrates seamlessly with your existing Notes infrastructure. But if you're not that familiar with the Notes environment, you may find Domino.Merchant ($1,295 list) quite challenging to use.

This package uses Domino Server's powerful workflow and security features to provide everything from Web site design to order processing. The workflow functionality of Domino.Merchant lets you set up approval processes and routing to create and maintain content on your Web site. Site security is provided by Access Control Lists and role assignments.



With a Web browser, Lotus Domino.Merchant contributors can check the status of a page, view the file library, or add content to a site area.

Building your Web site with Domino .Merchant requires some careful planning. You should determine the site's configuration and design before you start. During planning you must decide, for example, who is allowed to create content and who is responsible for approving it. You must also determine such options as whether to allow anonymous shopping or employ SSL (Secure Sockets Layer).

Once you have entered all of this configuration and design information into the Site Creator templates, you press the Generate Your Site button. AppAssembler, the C/C++ program module included with Domino.Merchant, then combines these templates with objects from a library to create Notes databases—one database for each site area you specified in the configuration—forming the shell of your site.

It is important to note that of the products we reviewed, only Domino.Merchant keeps content creation and content maintenance separate from site generation and site maintenance. For example, separating these two processes lets the marketing department concentrate on the product area of your storefront while the Notes administrator concentrates on administering and maintaining your site.

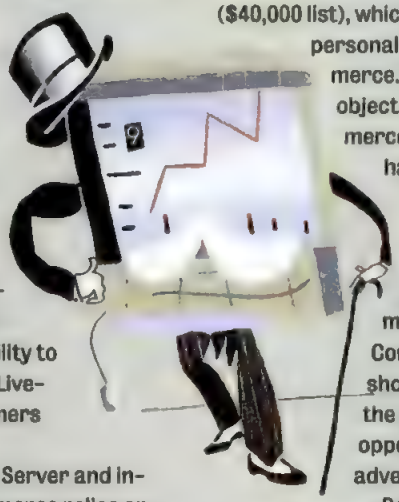
Before you can add content to your site or publish it so that shoppers can access it, you must first edit and save each area's home page. Then you can add text, product information, HTML, and graphics to each document and submit each page for approval prior to public release. To customize your site, you can add objects to the library for bringing into Web pages and can easily add HTML or CGI scripts. You can also change the background colors and text appearance in any of the predefined templates in the library.

Like many of the products we reviewed, Domino.Merchant can calculate shipping charges based on orders. And it comes with the ability to process payments using a third-party product from CyberCash. For tax calculations, Domino.Merchant relies on Taxware.

Domino.Merchant inherits its best features (security and workflow capabilities) from Domino Server. If you are already working in a Notes environment and would like to have a storefront presence on the Web, you'll find that Domino.Merchant allows you to control every aspect

Big-Business E-Commerce

The Web storefront creation packages we review in our main story are suitable for a wide range of businesses. But large retailers such as Macy's or CompUSA, or even bookseller Amazon.com, have different demands that out-of-the box solutions typically do not address. High-end e-commerce products pack many features you won't find in most midrange products. These include a scalable architecture, connectivity to back-end payment processors such as First Data Corp. (FDC), interfaces for legacy system integration (such as inventory and order processing), and sophisticated sell and cross-sell features to promote higher-volume sales. Here we look at three high-end products: Open Market's LiveCommerce and Transact, Actra's Netscape Merchant System, and BroadVision's One-to-One Commerce Server. (Actra Corp. is a joint venture between Netscape Communications Corp. and GE Information Services.)



Historically, Open Market has focused on the back-end transaction portion of electronic commerce. A new product called **LiveCommerce** ($45,000 list) adds the missing storefront features to Open Market.

LiveCommerce comes from Open Market's acquisition of Waypoint Software in the first quarter of 1997. It includes a set of templates and utilities to help build and manage a large catalog of products. OpenMarket has built attribute-based searching—the ability to search on specific fields in a database—into LiveCommerce, so content managers and customers alike can search for products of interest.

LiveCommerce runs on top of Windows NT Server and includes ODI's ObjectStore database. LiveCommerce relies on Transact for all customer orders, but note that you don't need Transact to use LiveCommerce.

Open Market has also revamped its marquee product, **Transact 3.0** ($125,000 list), to support a distributed e-commerce architecture. You can link any catalog to Transact using a set of tags and scripts collectively known as SecureLink. This two-step model gives rise to some unique applications. First, Transact is well suited to electronic malls, where one company can set up the back-end payment transaction infrastructure and individual merchants can handle their own storefronts. Because the catalog and transaction server are decoupled, merchants can send e-mails to potential customers with embedded links that send orders directly to the Transact server. Transact runs on three Unix systems—HP-UX, SGI Irix, and Solaris—and on top of either an Oracle or Sybase database.

A veteran of the e-commerce wars and site implementer for J.C. Penney's and REI, **Netscape Merchant System 1.6** ($63,000 list, including Oracle 7.3), from Actra Corp. is a powerful solution for front-end catalog management and back-end order management and payment processing. The Merchant System architecture includes three servers: one where you stage your site, one for your live site, and one to perform transactions.

Merchant System was developed and marketed by Actra as part of its Commerce Xpert products, and Netscape provides technical support. It runs on top of Oracle 7.3 and Netscape's Enterprise Server 2.01, and it also runs on a number of Unix platforms including Solaris, AIX, DEC Unix, HP-UX, and Irix.

A new version of the product, called Merchant Xpert 2.0, is expected to ship early next year. It will include such features as personalization (the ability to direct content to customers based on their preferences) and order tracking. The servers will be rewritten using the Netscape One (Java, JavaScript, and Corba) development environment.

BroadVision has built a commerce application on top of its powerful base package, **One-To-One Commerce Server 1.6** ($40,000 list), which provides content management and flexible personalization ideally suited for electronic commerce. The Commerce piece adds the templates, objects, and business rules relevant to e-commerce. Kodak and the Internet Shopping Network have built stores using this product.

One-To-One's dynamic personalization sets it apart from other high-end solutions. When site visitors input product and category preferences on a Web page form, the merchant can use One-To-One's Dynamic Command Center to tailor each customer's shopping experiences and match products to the customer's preferences. There are endless opportunities for cross-selling, up-selling, and advertising.

Behind the scenes, merchants use a utility called the Content Management Center to enter and categorize products. A batch upload utility makes multiple-product entry easier. Back-end shipping, taxes, order fulfillment, and payment processing are handled via BroadVision's extensible *open adapters*.

One-To-One runs on top of Microsoft Windows NT 4.0 or an Informix, Oracle, or Sybase database on Sun Solaris. The package has a complex pricing scheme based on the number of developers, content managers, marketers, and profiled users. Plan to spend upwards of $100,000.—*Robert P. Lipschutz*

LiveCommerce 1.0. List price: $45,000. **Transact 3.0.** List price: $125,000. Open Market Inc., Cambridge, MA; 888-673-6658; www.openmarket.com. *Circle 473 on reader service card.*

Netscape Merchant System 1.6. List price: $63,000 (includes Oracle). Actra Corp., Sunnyvale, CA; 800-638-7483, 650-937-2555; www.actracorp.com. *Circle 474 on reader service card.*

One-To-One Commerce Server 1.6. List price: $40,000 per developer; other pricing based on number of users. BroadVision Inc., Los Altos, CA; 800-398-9660, 650-943-3600; www.broadvision.com. *Circle 475 on reader service card.*

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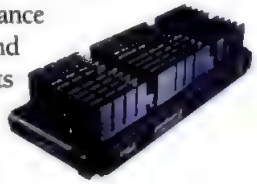

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of the project.—*Dawn A. Learned*

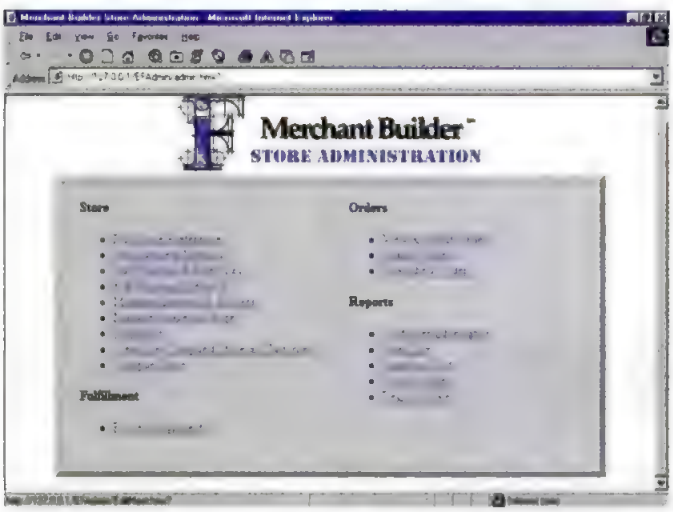
Lotus Domino.Merchant 1.1. List price: $1,295. Requires: 486-based PC or better (Domino Server); 64MB RAM, 50MB hard disk space; Microsoft Windows 95, NT 3.51 or later, or OS/2; Domino Server 4.5*x* or later. Lotus Development Corp., Cambridge, MA; 800-343-5414, 617-577-8500; fax, 617-693-3899; www.lotus.com. *Circle 466 on reader service card.*

The Internet Factory Inc.

Merchant Builder

With an intuitive approach to e-commerce and a reasonable price ($1,495 list), Merchant Builder 2.1 is designed to let you host your own site. For those who don't already have a Web server, a copy of The Internet Factory's Commerce Builder is included, but Merchant Builder can also run on any ISAPI or NSAPI server. Commerce Builder runs under Windows 95 or NT and provides the backbone of your storefront with little additional overhead.

Once you've completed installation, you don't need any other proprietary software to build and configure your storefront. Merchant Builder handles all administration and design through your Web browser. By attaching to the *localhost* alias, you can build your Web site on the same machine as your Web server. This browser-based construction also lets you test your store as you build it, showing you the exact interface your customers will see. The useful staging area exactly mimics your live store in both appearance and functionality.



Merchant Builder's rich administration features make it easy to configure every aspect of your storefront.

Merchant Builder's approach to commerce sets it apart from the other products we looked at by providing the truest retail back-end experience. Setting up departments and product lines is highly intuitive. Product creation is detailed but simple: Each product in your store has an individual SKU, and you can set up SKU sets for items available in different sizes or colors. Items in an SKU set share a common base SKU, with qualifiers to identify specific options. This requires a little more work up front, but it is an intelligent way to handle items with a variety of options.

Unfortunately, other tasks in Merchant Builder aren't as straightforward. For example, taking your store's existing data and porting it to the Web is not a simple matter: Merchant Builder doesn't let you import data directly from another source. And because Merchant Builder uses a fully relational database, you must understand the schema to prevent errors. It is easier to enter products manually, but this approach clearly will not work for companies with large existing product databases.

Because Merchant Builder runs on your Web server, you can establish more than one storefront and create a virtual mall with as many stores as you have licenses. This capacity for hosting multiple sites makes Merchant Builder an excellent solution for ISPs that provide e-commerce to their clients. A Mall Administration utility lets you manage each store in your mall from a browser, controlling default settings for each. The equally powerful Store Manager tool provides access to reporting and statistical functions as well as key maintenance for your store. Users who need more power than Merchant Builder provides natively will be glad to find that the program is fully extensible through the use of a Server Macro Expansion (SMX) macro language.

Merchant Builder takes the middle road. It is not as easy to use as true entry-level products, such as Internet Creator or Viaweb Store. Nor does it match all the features found in more robust (and expensive) programs such as Electronic Commerce Suite or Microsoft Site Server. But its intuitive approach to site design and impressive site maintenance tools make it a strong contender.—*HHH*

Merchant Builder 2.1. List price: $1,495. Requires: 486-based PC or better, 24MB RAM, 100MB hard disk space, Microsoft Windows 95 or NT 3.5 or later. The Internet Factory Inc., Pleasanton, CA; 510-426-7763; fax, 510-426-9538; www.ifact.com. *Circle 467 on reader service card.*

Microsoft Corp.

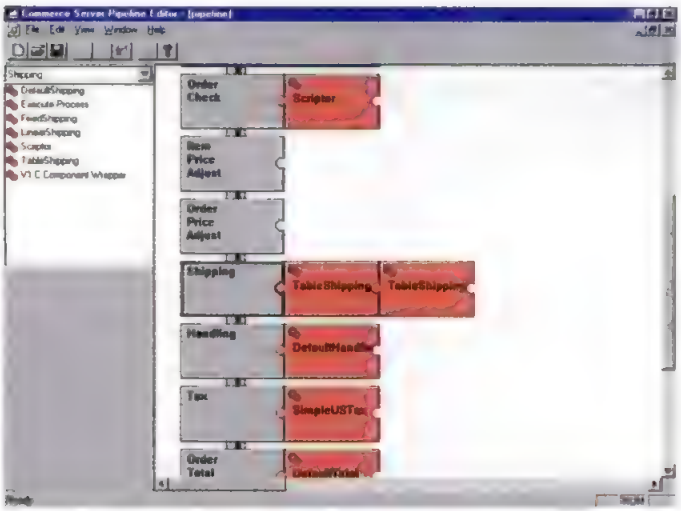
Microsoft Site Server

With the release of Microsoft Site Server 2.0 (Enterprise Edition), Microsoft is playing to win. This product ($4,999 list) includes lots of new features and a substantially improved version of Microsoft Commerce Server, the base product. Absent, however, are the variety of templates we've come to expect, ease of customization, and a bundled database.

The Enterprise Edition is a combination of several applications, including Commerce Server 2.0. The price includes site and content management tools and such technology as the Personalization System, Usage Analyst, Site Analyst, and Web Publishing Wizard. Microsoft's Visual InterDev is also included, but surprisingly, SQL Server is not. Thus, you'll need to provide an ODBC-compliant database.

At the heart of the Site Server solution is Microsoft's Active Server Page (ASP) technology. ASPs are server-side scripts that you create using JavaScript or VBScript. This support for dual scripting languages is unique and presents a good solution for shops that haven't committed to either. ActiveX is also part of the mix, providing shoppers' member registration forms with a Windows 95 look and feel.

Site Server's database management approach proved to be its most distinguishing feature. Unlike other products in this roundup, Site Server is schema-independent, which makes linking it to existing databases especially easy. On the downside, importing our data required a two-step process, because we had to augment the schema before importing the data.



Microsoft Site Server's Pipeline lets site developers visually define the sales transaction process.

Included site development tools such as Visual InterDev (see the story "From the Ground Up" in this issue) are world-class.

When we created our test store, Site Server gave us the option to build from the ground up or work with one of the canned (or starter) stores. The Store Builder Wizard automatically created a default schema with such basic information as customer and product data, then let us design our store using a variety of fonts, colors, and navigation controls.

Customization options are limited. To bend the site to your will, count on some additional JavaScripting or VBScripting through Visual InterDev. You also need to acquaint yourself with the Personalization System, which works with an ASP to generate Web pages dynamically for user preferences.

The Store Manager let us put items on sale, track orders, and add, delete, and edit products. Site Server also provides detailed viewing and reporting. We could review our test orders any number of ways, including by product, member (customer), or range of time. Deeper reporting is available for site administrators through the Usage Analyst module, which provides over 25 prebuilt reports on site usage.

The most impressive feature of Site Server is its Order Processing Pipeline, which defines the flow of a sales transaction. Though other products provide similar information, the Pipeline serves up a visual depiction of the sales transaction stages. The Order Processing Pipeline handles targeted functions such as taxes, shipping, and payment. The Pipeline also integrates with third-party products such as CyberCash and Taxware.

There's no doubt that Site Server provides an infrastructure for success, but you can count on a good deal more customization work than with competing products.—*DSL*

Microsoft Site Server 2.0 (Enterprise Edition). List price: $4,999. Requires: Pentium/133-based PC or better, 64MB RAM, 600MB hard disk space, Microsoft Windows NT 4.0. Microsoft Corp., One Microsoft Way, Redmond, WA; 800-426-9400, 425-882-8080; www.microsoft.com. *Circle 468 on reader service card.*

IBM Corp.

Net.Commerce

Advantages of IBM's Net.Commerce 2.0 ($4,995 list) include an easy installation routine, advanced site management features, and the ability to build Web storefronts using either canned or custom templates. Database support, Web server support, and ease of use, however, continue to lag behind the competition.

Net.Commerce 2.0 offers improved interoperability and packs just a few new features over the previous version: It works with Netscape Enterprise Web Server; it provides discount functions and order viewing and updating; and its search engine has been brought up to date. Also new is the Extended Market Targeting feature, which lets you provide shoppers with exclusive text, graphics, and multimedia features tailored to match their interests. Net.Commerce runs under Windows NT and Unix (IBM's AIX and Sun Solaris). Though IBM has also added some ODBC support in this version, database support remains limited. Net.Commerce supports DB2 right out of the box, but ODBC support is restricted to Oracle.

We also encountered problems setting up our test store. Importing our test data into Net.Commerce's database using its mass import feature was difficult: Before we could feed the data to DB2, we first had to write an application for converting the data into a proprietary format. As a result, Net.Commerce fared the worst on this portion of our tests.

Although we didn't test the performance of the servers we reviewed, it's worth noting that Net.Commerce provides a sophisticated caching mechanism. Another performance enhancement is the product's ability to add multiple machine configurations and multiple instances of Net.Commerce to a single machine.

The Site Manager lets you add and remove stores, edit user interfaces, and maintain data (such as member information) sitewide right out of the box. We used the Site Manager to assign a mall header, footer, and home page for our test site, as well as to define the shopping processes for the store. It also let us assign macros or APIs to customize the site further.

Store Manager let us customize the look and feel of our test store using traditional HTML. It was easy to create and

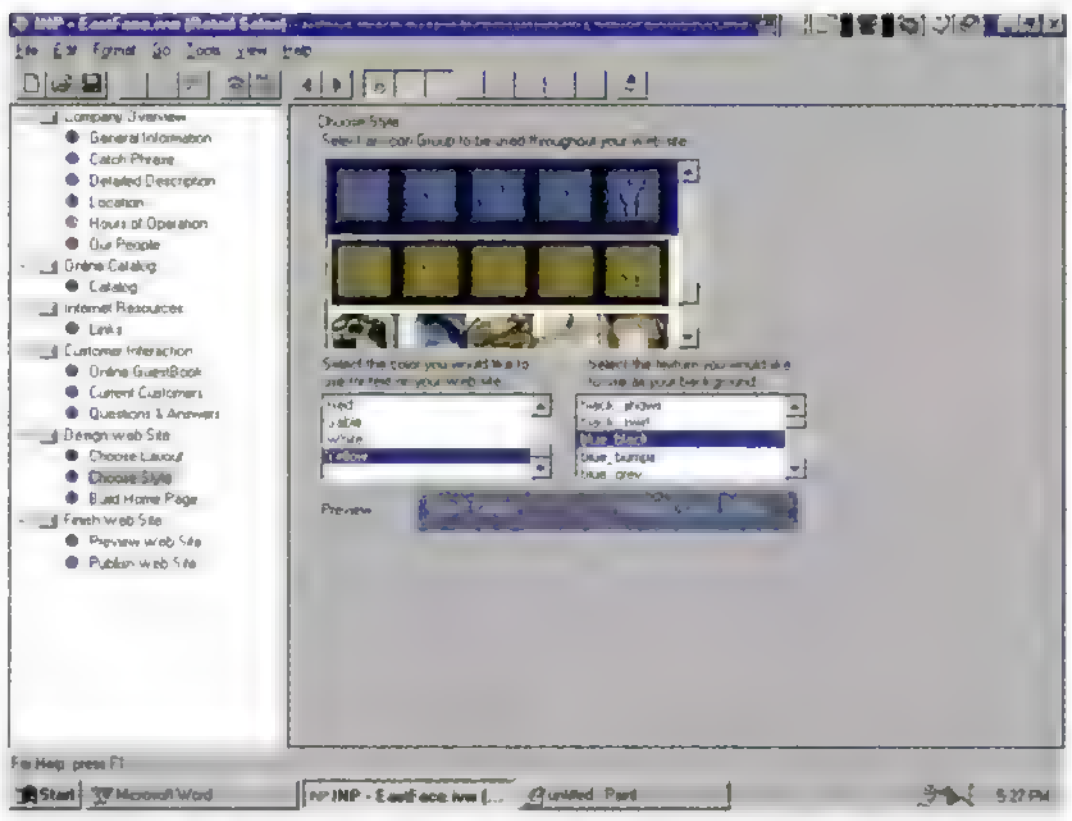
Net.Commerce comes with some excellent sample storefronts.

manage product categories as well as to maintain product information. Net.Commerce includes Template Designer, a Java applet that provides a basic WYSIWYG interface for creating HTML templates. A wizard built into Template Designer helps you select the proper database tables and fields for display and guides you through the process of embedding SQL queries for extracting data.

Net.Commerce also supplies a wide array of APIs for typical sales transaction processing. If you can't find an API that suits your needs, you can customize or create one. The documentation is complete but lacks information on database support.

Those looking for an easy-to-use, rock-solid, and scalable solution will find Net.Commerce attractive. The package falls short for users who require heavy sales transaction customization or who are looking for advanced heterogeneous database features.—*DSL*

Net.Commerce 2.0. List price: $4,995. Requires: Pentium/166-based PC or better, 64MB RAM; hard disk space depends on database; Microsoft Windows NT 4.0, IBM AIX 4.1 or later, or Sun Solaris. IBM Corp., Armonk, NY; 800-365-4426; www.ibm.com. *Circle 469 on reader service card.*



PeachLink gives you a number of design styles that you can use to make an attractive Web site.

Peachtree Software

PeachLink

Using an innovative twist, PeachLink lets businesses start peddling their wares on the Web fast. This inexpensive ($49.95), easy-to-use package sets itself above the competition by offering a unique link to Peachtree Software's popular small-business accounting package, Peachtree Complete Accounting ($200 street), which won an Editors' Choice in our roundup of May 6, 1997.

Using PeachLink's Order Processor, you simply click a button and the program posts downloaded Web orders directly into your Complete Accounting system. Small businesses already using Complete Accounting for bookkeeping, as well as start-ups seeking a small-business accounting program, should seriously consider PeachLink for their Web storefronts.

Peachtree has announced that it will soon bundle PeachLink with Complete Accounting at no additional cost. This will make PeachLink the first comprehensive, storefront-ready accounting package. Unlike the other storefront products that we reviewed, however, PeachLink does not calculate shipping or sales tax. A Payment Shipping information box allows you to enter notes for shoppers about shipping and other costs, but PeachLink is not a complete e-commerce solution.

The Web site generation tool bundled with PeachLink is Harbinger's TrustedLink INP (Instant Net Presence). Building your Web site with TrustedLink INP is a breeze, and as with Forman Interactive Corp.'s Internet Creator, it can be done in less than an hour. You simply open a worksheet and provide information as the program prompts you during an interview process. You can choose from predefined Web site styles, and if you don't want to include a particular worksheet as part of your Web site, simply select the Exclude Step option from the Tools menu. Graphics, such as your company logo or images of products in your company line, can be added to selected worksheets.

Publishing your site is as easy as building it. Site hosting is provided by Harbinger. Once you have registered, launch your browser so that you are working online and press the Publish Web Site button; all the files are transferred to Harbinger automatically. Updating your Web site follows the same procedure.

The Order Processor lets you transfer customer orders from your storefront to your Complete Accounting system, download orders from your Web site for viewing or printing, and ultimately post these orders to your accounting system once they have been reviewed. We found it to be a simple, straightforward tool. Once you fire up your browser, simply launch PeachLink and press the Get Orders icon; your orders then appear in the Order InBox window. When you have reviewed the orders, you may either drag and drop them to the Processed Orders window or prepare them for transfer to your accounting system. Preparing orders for transfer to Complete Accounting consists of associating each downloaded order with a customer number and posting it to the accounting system, a relatively easy process.

PeachLink is an effortless, inexpensive tool ideal for small-business owners who want to expand their customer base without investing much time or money. It lets you concentrate your efforts on your market, not the technology.—*DAL*

PeachLink. List price: $49.95; 30 hosting days free; monthly hosting fee, $79.95; domain name registration fee, $150; 5 hours of Internet usage free; monthly Internet access: 5 hours, $9.95; each additional hour, $1.99. Requires: 386-based PC or better, 8MB RAM, 28MB hard disk space, Microsoft Windows 95. Peachtree Software, Norcross, GA; 800-247-3224, 770-724-4000; fax, 770-564-5888, www.peachtree.com. *Circle 470 on reader service card.*

ICentral Inc.

ShopSite Manager

One of the best-selling Web storefront products, ShopSite Manager 3.1 ($495 list) is a simple solution that offers quick setup, a basic set of templates, and enough features to make getting an at-

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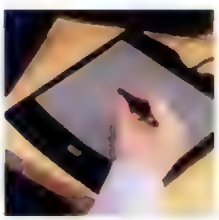

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SUMMARY OF FEATURES

Web Storefront Creation Software

WEB START-UPS

BIGGER BUSINESSES

■ YES ■ NO
Products listed in alphabetical order within each category

	Cartalog 4.0	Internet Creator 4.0	PeachLink	Viaweb Store 3.0	Cat@log Builder 2.0	Electronic Commerce Suite 3.0, Professional Edition	Intershop Online 2.0
List price	$50 per month	$149	Monthly hosting fee, $49.95	$100 per month	$4,995 (entire suite)	$9,995	$4,995
Platforms supported	Any platform with a browser	Windows 95, 3.x, NT 4.0	Windows 95	Any platform with a browser	Windows 95, NT 4.0	Mac OS, SGI Irix 5.3 or later, Sun Solaris 2.4 or later, Windows 95, NT 3.51 or later	Windows NT, Unix
Web servers supported	N/A	Apache, Microsoft, Netscape	N/A	N/A	ISAPI, any CGI	Apache, Microsoft, Netscape, Open Market, O'Reilly, Quid Pro Quo, Webstar	AOLserver, Apache, CERN httpd, Connect Server (Gradient), IBM, Java Web Server, Microsoft, NCSA, Netscape, Open Market, Oracle, Spry, Stronghold, Tandem iTP
Store Setup and Publishing							
Number of full storefront templates	None	16	11	1	None	20	3
Includes wizard for starting store	■	■	■	■	□	□	■
Includes HTML editor/WYSIWYG editing	□ □	■ ■	□ □	■ ■	□ □	□ □	■ ■
Supports frames/tables	■ ■	■ ■	□ □	■ ■	■ ■	■ ■	■ ■
Supports multimedia (audio and video) files	■	■	□	■	■	■	■
Supports ActiveX/Java	■ ■	■ ■	□ □	■ ■	■ ■	■ ■	■ ■
Supports forms creation	■	■	□	■	■	■	■
Software registers your domain name	□	■	■	□	□	□	□
Supports customer registration	□	□	■	□	□	■	■
E-mail templates	□	■	□	□	□	■	■
Database							
Includes database server software	□	□	□	□	□	■	■
Supports ODBC	□	□	□	□	■	■	■
Native drivers for Oracle/Sybase/Informix	□ □ □	□ □ □	□ □ □	□ □ □	□ □ □	□ □ □	□ ■ □
Supports SQL	□	□	□	□	□	■	■
Imports database files	■	■	■ (ASCII only)	■ (ASCII only)	□	■	■
Exports database files	□	□	■ (ASCII only)	□	□	■	■
Maintains inventory/customer databases	□ □	□ □	□ ■	□ □	□ □	■ ■	■ ■
Databases can be administered via browser	□	□	□	□	□	■	■
Transactions and Security							
Calculates shipping charges	■	■	□	■	■	■	■
Calculates state/local taxes	■ ■	■ □	□ □	■ ■	■ ■	■ ■	■ ■
Supports all major credit cards	■	■	□	■	■	■	■
Shopping basket	■	■	■	■	■	■	■
Supports quantity pricing	■	■	□	■	■	■	■
E-mail order verification	■	■	■	■	■	■	■
Supports Checkfree/FirstVirtual/CyberCash	□ □ ■	□ □ ■	□ □ □	□ □ □	□ ■ ■	■ ■ ■	□ □ ■
Supports SSL 2.0/SSL 3.0	■ ■	■ ■	■ □	■ ■	■ ■	■ ■	■ ■
Supports SET/S-HTTP	□ ■	□ ■	□ □	□ ■	□ ■	□ ■	□ ■
Administration and Sales Support							
User can view/edit store's site hierarchy	□ □	■ ■	■ □	■ ■	■ ■	■ ■	■ ■
User can check for internal/external links	□ □	■ □	□ □	□ □	□ □	□ □	□ □
Analysis tools for tracking visitors	■	■	■	■	□	■	■
Staging area for group site authoring/editing	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
User can create promotions	□	□	□	■	□	■	■
Allows dynamic discounting	□	□	□	□	□	■	■
Shipment tracking	□	□	□	■	□	□	■
Generates invoices	□	□	■	□	□	□	■
Generates sales/inventory reports	■ □	□ □	■ □	□ □	□ □	■ ■	■ ■
Links to legacy accounting systems	□	□	■	□	□	■	■

N/A—Not applicable: This product is a service and does not require the user to set up a Web server.

See www.pcmag.com for interactive views

PC MAGAZINE EDITORS' CHOICE

	Lotus Domino.Merchant 1.1	Merchant Builder 2.1	Microsoft Site Server 2.0	Net.Commerce 2.0	ShopSite Manager 3.1
	$1,295	$1,195	$4,999 (Enterprise version)	$4,995	$495
	Windows 95, NT 3.51 or later, OS/2	Windows 95, NT 4.0	Windows NT (Alpha and x86)	IBM AIX, Windows NT, OS/390, Sun Solaris	BSDI, Linux, (on Intel), Sun Solaris (on SPARC)
	Lotus Domino	Commerce Builder, any ISAPI/NSAPI	Microsoft	IBM, Netscape	Apache, Netscape, Stronghold, Unix
	13	None	4	3	6
	■ (ASCII only)				■ (tab-delimited only)
	■ (ASCII only)				

tractive Web site up and running almost fun. ShopSite's limitations can make it a daunting product, but users running Unix sites who need only a transaction-based system should find it a competitive product and a relative bargain in the midrange category.

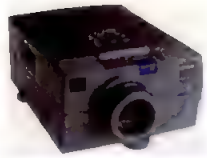
ShopSite runs on several flavors of Unix, including Sun Solaris and the low-cost or free BSDI and Linux variants. For the bargain-minded, it supports Apache's Web server software, as well as Netscape's and several others.

Setting up the product was a typical Unix experience. While ShopSite's Web page offers some useful and detailed information, the steps for configuring ShopSite were less clear than we had hoped. This lack of step-by-step documentation may not pose a significant problem for Unix hackers and ISPs, but it will undoubtedly discourage those with less Unix experience.

Once the product was installed, we found it easy to use, with straightforward steps for creating a site and populating it with products. ShopSite's templates let you easily enter product information and build pages. Getting the site ready for business is a three-step process. First, you enter all of your product information. Then you build the pages that will form the basis of your site. Finally, you "assign," or link, the products to the appropriate pages. And you can register your store with ICentral's main mall to get exposure the minute your site is online.

The storefront product information that you can enter is limited to the standard fields supported by ShopSite Manager. Adding variations of a product based on such attributes as color or size proved impossible. ShopSite does offer a workaround, but this requires extra data entry. And since ShopSite uses an internal proprietary database for storing product information, you can access the workaround only through ShopSite's data entry screens or the import feature. It took several tries to get product data from our tab-delimited file into the system with the fields correctly assigned.

ShopSite Manager is transaction-based only. Users can order products and pay for them through an extensive set of payment options. Customers (and the store manag-



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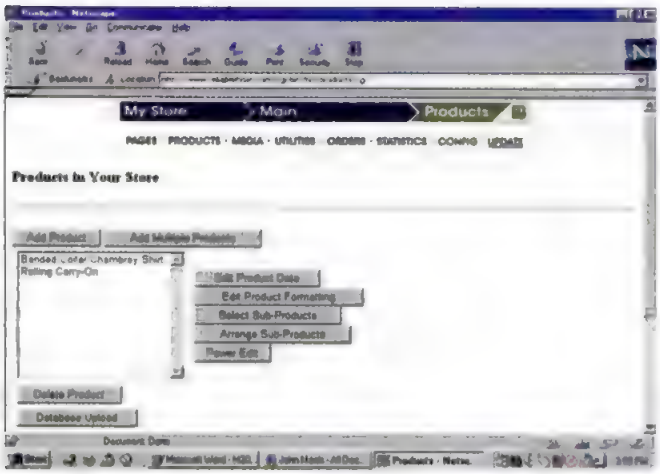

In ShopSite, you enter your products, build the pages that form the basis of your site, and then assign products to these pages.

er) receive e-mail confirming orders. But because ShopSite does not track inventory, you won't receive out-of-stock warnings, and you cannot process transactions for items on back order. The shipping and tax information choices, on the other hand, are well thought out and extensive. But ShopSite's site analysis and reporting tools are limited: The software logs only product volume information and page hits.

An easy-to-use tool, ShopSite can help you set up your Web store in no time. But it is not the product for those without Unix experience, so it may be more appropriate for ISPs or resellers who set up storefront malls. A Windows NT version, due out soon, will help position ShopSite as an appealing option priced between entry-level and midrange products.—*Steve Buehler*

ShopSite Manager 3.1. List price: $495. Requires: 486-based PC or better, 16MB RAM, 10MB hard disk space, Unix. ICentral Inc., Provo, UT; 801-373-4347; fax, 801-373-7211; www.icentral.com. *Circle 471 on reader service card.*

Viaweb Inc.

Viaweb Store

PC MAGAZINE EDITORS' CHOICE

The only product in our roundup that is solely vendor-hosted, Viaweb Store 3.0 shines brightly amid the e-commerce crowd. You don't have to install any proprietary software: With only an Internet connection and your browser, you can quickly build and deploy a stellar e-commerce site. The test-drive feature on Viaweb's site claims that you can build a store in less than 10 minutes, and—believe it or not—it's no exaggeration. Viaweb's pricing structure is also quite enticing: $100 per month for a store with up to 20 items, and only $300 per month for up to 1,000 items.

Viaweb provides a powerful tool for developing your site. You can select from several editing modes; these range from a WYSIWYG environment to a hierarchical outline view that lets you drill into any piece of your site with a single mouse click. Because you develop your site directly

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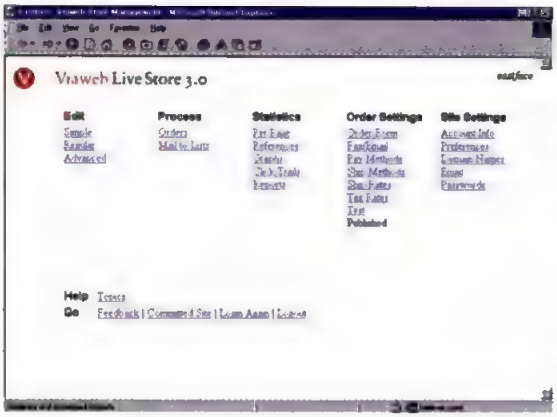

The browser-based interface and powerful administration features make Viaweb an excellent e-commerce solution.

from your browser, you can easily test as you go without leaving your staging area. Posting your site to the live area is extremely easy. Clicking a single hyperlink publishes your site immediately, and your customers will be able to start shopping even as you continue adding features. Viaweb is also multiuser, so you can have an entire team developing and maintaining your site simultaneously.

Extending your site is relatively painless. Creating promotions in your online store can be done with just a single mouse click. Adding to your inventory is no more difficult than setting up your initial site. You can also import existing ASCII data to your site; despite some formatting restrictions, importing is still a straightforward process. A word of warning: Some browsers do not support file uploads.

The management tools provided by Viaweb are superb and truly set it apart from other entry-level products. The store administration features allow you to set up sales tax and shipping rates with a tremendous degree of detail. Once you have entered the figures, you can test them for accuracy before publishing the current tables to your site—a clever feature not found in the other products we tested. And the reporting tools match Viaweb's editing functions in both power and simplicity. You can quickly retrieve important data, such as referral information telling you where each visitor came from and how much was spent, or trails detailing the exact path a customer took through your site and what ended up in the shopping basket. In addition, Viaweb provides all the basic site statistics you'd expect to see for your own Web server.

Viaweb Store has taken e-commerce to a new level, making this expanding field readily accessible to anyone who has an Internet connection. The test-drive feature allows anyone to create a site and test it for ten days free, giving users the opportunity to determine whether this approach will work for them. The top-notch power and HTML-based interface make Viaweb a very appealing option for anyone seeking to get online quickly with a small budget and little time to invest in Web site design.—*HHH*

Viaweb Store 3.0. List price: $100 per month and up. Requires: Web browser, Internet connection. Viaweb Inc., Cambridge, MA; 888-484-2932, 617-876-2692; fax, 617-354-2624; www.viaweb.com. *Circle 472 on reader service card.* PC

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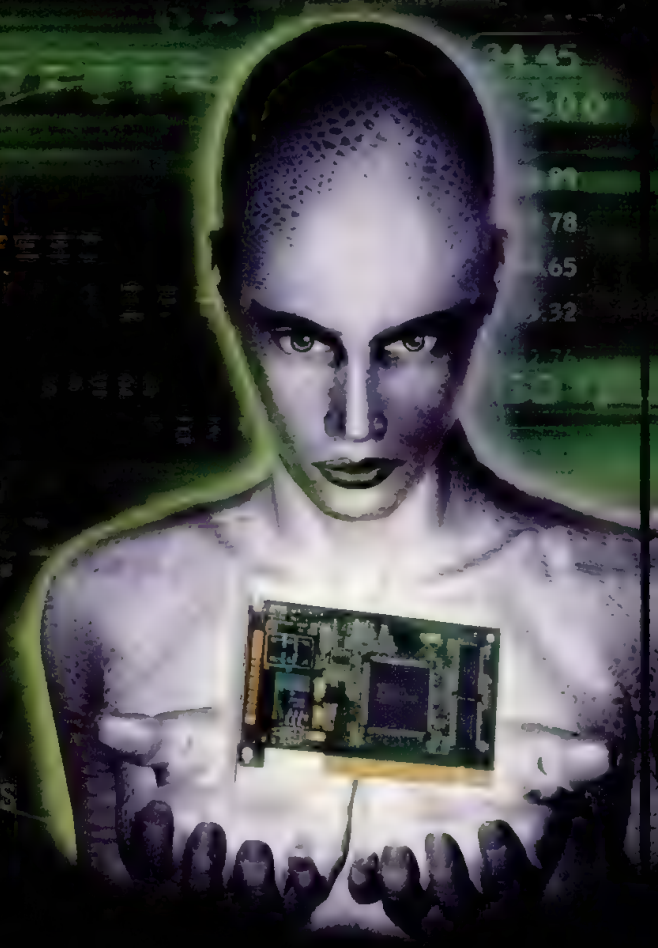

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* Estimated street price. Ultim@te Race is a PowerVR Extreme™ software game. PowerVR and PowerVR Extreme™ are trademarks or registered trademarks of VideoLogic Ltd. (UK). All rights reserved. Used with permission. NEC Electronics Inc. (USA) and Matrox Graphics Inc. (Canada) are authorized distributors of Ultim@te Race. NEC Electronics Inc. is a worldwide distributor and licensee of PowerVR software games developed by Kalisto Entertainment S.A. (France). ©1997 Raven Software Corporation. All rights reserved. Id Software, Inc. software code contained within Hexen II™ ©1996 Id Software Corporation. All rights reserved. Developed by Raven Software Corporation. Published by Id Software, Inc. Distributed by Activision, Inc. under sublicense. Hexen™ is a registered trademark and Hexen II™ is a trademark of Raven Software Corporation. The Id Software name and the Id logo are trademarks of Id Software, Inc. Activision® is a registered trademark of Activision, Inc.
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Stepping Up to DVD

You're ready for DVD. But is it ready for you? We test six DVD-ROM upgrade kits to show you where they shine—and where they slip.

By Alfred Poor

The replacement of the CD-ROM has begun. DVD, the new optical-disk format, is poised to take the desktop computing and home entertainment markets by storm.

DVD disks and DVD-ROM players look much like their familiar CD counterparts, with one important advantage: Whereas a CD can hold 650MB of data, the first-generation DVD disk can store 4.7GB (4.7 gigabytes)—enough for 2 hours of quality full-motion video, with room to spare. Subsequent generations of the shiny platters promise to hold up to 17GB. Moreover, DVD-ROM players in PCs will be able to play current CD-ROM disks (though not CD-Rs in all cases, as we'll discuss later), plus the movie titles that will be released for use in home-theater DVD players in the consumer electronics area.

The Hollywood motion picture industry is behind the new media, with titles here or on the way from the collections of Columbia/TriStar, MGM, Polygram, Sony, and Warner. And in September, Disney announced that it, too, would be releasing some movies on DVD.

For computer users, however, DVD means more than just movies. The unprecedented storage capacity lets application vendors fit multiple CD titles (phone databases, map programs, encyclopedias) on a single disk, making them more convenient to use. Developers of edutainment and reference titles are also free to use video and audio clips more liberally. And game developers can script interactive games with full-motion video and surround-sound audio with less fear of running out of space. By the time you read this, more than 600 DVD movie and application ti-

www.pcmag.com

Are any of these kits right for you, or are you better off waiting for the latest DVD-ROM solutions? Visit the interactive version of this story and see for yourself.

PHOTOGRAPHS BY THOM O'CONNOR

The CD Family

	CD-ROM	CD-R (compact disk–recordable)	CD-RW (compact disk–rewritable)	DVD-ROM	DVD-RAM	DVD+RW
Price	Included in most systems; $100 for an aftermarket upgrade to a 24X drive	$400–$800	$500–$900	$300–$600	$500–$700 (estimated)	$500–$700 (estimated)
Capacity	650MB	650MB	650MB	4.6GB (upgrade path to 17GB)	2.6GB	3GB
Biggest plus	Current standard for data distribution	Disks you create can be read by virtually any CD-ROM drive (and audio disks can be used on CD players).	CD-RW disks are rewritable, while CD-R disks created with a CD-RW drive can be read by virtually any CD-ROM drive.	Huge capacity for new multimedia titles, while maintaining compatibility with existing CD-ROM disks	Huge, rewritable capacity	Huge, rewritable capacity
Biggest minus	Read-only	Disks can't be read by first-generation DVD-ROM drives.	CD-RW disks can't be read by most CD-ROM drives now installed or by first-generation DVD-ROM drives.	First-generation drives can't read CD-R or CD-RW disks.	Small installed base of DVD-ROM users to share DVD-RAM disks with.	Uncertain market acceptance and small installed base of DVD-ROM users to share disks with.
Target users	All PC users	Corporate users who need to archive or share data; home users for backup and Photo CDs; multimedia developers; musicians	Corporate users who need to store or share data that needs to be updated periodically.	All PC users	Corporate users who need to archive or share large amounts of data; multimedia developers.	Corporate users who need to archive or share large amounts of data; multimedia developers

tles should be ready. (For a look at five of the first ones, see the sidebar "DVD Titles: Better Games, More Data, Lots of Video.")

PCs with DVD support are already showing up on the market. And for the millions of computer owners who don't want to be left behind, vendors have rushed to offer DVD upgrade kits that end users can install on their own.

REVIEW CRITERIA

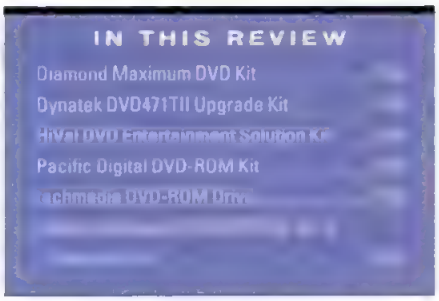
For this story we tested DVD-ROM upgrade kits aimed at aftermarket buyers. Each kit had to include the drive, the MPEG-2 video decoder board needed for video playback, and all the necessary cables and instructions. Six kits—from Diamond Multimedia, Dynatek, HiVal, Pacific Digital, techmedia, and Utobia—were ready in time. Several more kits are being readied for the holiday season, chief among them offerings from Creative Labs, Panasonic, Philips, Samsung, Sony, and STB Systems.

Some users may remember the wild and woolly days of multimedia upgrade kits, when the arrival of Windows 3.0 made a CD-ROM drive and a sound card essential components of a desktop computer. That era ushered in a flood of poorly designed kits that were difficult to install and created more problems than they solved.

Our experience with the kits we tested was much better. Windows' Plug and Play does make installation easier, and these kits are much less prone to the conflicts and complications encountered with some older multimedia upgrades.

A HARD LOOK AT HARDWARE

A DVD upgrade kit will set you back about the same amount as a new monitor; street prices for the kits range from $400 each (for the Diamond, techmedia, and Utobia bundles) to $700 (for the HiVal kit, which includes a wireless transmitter/receiver set to play DVD movies from your PC on a TV in another room without cables).



Our Contributors: ALFRED POOR and JAN OZER are contributing editors of *PC Magazine*. JAMES KARNEY is a frequent contributor to the magazine. JAMIE M. BSALES was the editor in charge of this story, and JEFF MACE was the project leader.

The bulk of the purchase price covers the hardware: a DVD drive and a decoder card. The key is the DVD drive itself. As noted earlier, DVD disks are the same size as CD-ROMs, but they can hold a lot more data. The specification was originally developed at the behest of Hollywood, which was looking for a digital way to distribute movies. The typical feature-length movie is 90 minutes or longer, and the studios wanted surround-sound audio (like that used in theaters) and the ability to have different audio tracks for different languages, as well as storage space for subtitles in different languages. The format had to support a wider aspect ratio of 16:9 (motion picture format) in addition to the 4:3 aspect ratio of traditional televisions and computer monitors.

These requirements added up to the need for more storage capacity on a disk—lots more of it. The 650MB capacity of a CD-ROM is sufficient to hold only

about 75 minutes of stereo sound—not enough for the sound track of a full-length movie, let alone the images.

By designing the disk drive with a laser using a shorter wavelength, engineers were able to move the data tracks closer together on a DVD disk than on a CD-ROM and to squeeze more data into a given length of track. As a result, a DVD disk can hold as much as 4.7GB of data on one side. The specification also calls for dual-layer disks that can hold 8.5GB per side. The DVD specification also includes "flippy" disks, which are recorded on both sides and will eventually hold a whopping 17GB.

For theater-like sound, the DVD specification calls for the use of Dolby Digital sound (sometimes referred to as AC-3), which is also known as 5.1-channel sound. This provides left, right, and center front channels plus separate left and right rear effects channels (requiring five speakers in all), plus a subwoofer signal (the ".1" in *5.1*). Movies that have been dubbed in other languages are mixed so the dialog is in the center channel. Change the language and a different sound track plays for just that channel; the sound effects and musical score remain unchanged.

A SHORT BIT ON COMPRESSION

The 4.7GB capacity may seem like an enormous amount, but it's still too small to fit a full movie of digitized images and sound without data compression. DVD uses MPEG-2 compression (from the Motion Picture Experts Group) for the video, and Dolby Digital compression for the audio (though European titles will use MPEG-2's audio compression scheme).

This data must be decompressed before it can be used. Your computer's CPU can perform the calculations required, but not fast enough to keep pace with the images and sounds and have cycles left for its other tasks, too. So a DVD upgrade kit adds a decoder board to the DVD drive. The decoder board processes the data stream as it's received from the DVD drive and sends out the images and sounds to your PC's graphics subsystem (or directly to the screen) and to its sound system.

The features that make DVD perfect for watching movies at home make them irresistible for computer use. In addition to the increased capacity, performance is also impressive: The first generation of DVD drives are able to read data at 1,350 KBps (kilobytes per second)—roughly the equivalent of 8X CD-ROM drives. Such speed makes it tempting to swap your existing CD-ROM drive for a DVD solution.

TOO SOON?

Is it too soon to upgrade your system to DVD? There are a number of developments that may encourage some users to wait before taking the plunge.

If you intend to use the system for data access—for instance, using DVD-ROM reference titles—you may want to wait for kits that include the next generation of DVD drives. Existing drives are fast, but there are already faster drives arriving on the market that claim 16X speed for DVD and 20X throughput in CD-ROM mode (versus the current 8X CD-ROM speed).

Another reason to avoid the first generation of drives is that although they can read mass-produced CD-ROMs, most drives cannot read the custom-burned CD-R (compact disk–recordable) disks, which are becoming more prevalent in the corporate world. On our tests, the one kit that could read CD-R (the Hitachi drive in the Pacific Digital kit) could not read all CD-R media. The next drives are expected to support all CD formats, including CD-R and CD-RW (compact disk–rewritable).

In fact, you may not want to get a DVD-ROM drive at all. Like CD-ROM, today's DVD is a read-only format. The first read/write/erasable DVD drives—called DVD-RAM—are expected to be on the market around the first of the year. Compatible with all CD formats and DVD-ROM disks, these drives will also provide large-capacity storage (2.6GB) for backup and archival purposes. Thus, a single device could serve many functions.

WAR OF THE ACRONYMS

At this point, the crystal ball is cloudy about the rewritable DVD market segment. The DVD Forum (the association formerly known as the DVD Consortium, the group of companies that originally developed the DVD specification) agreed on a DVD-RAM specification that used phase-change technology to reach a 2.6GB capacity per side.

Then a group of six companies—

Editors' Choice

Close, but not there yet

PC MAGAZINE EDITORS' CHOICE

These first-generation DVD upgrade kits all fall short of the mark for one reason or another. We would wait for the next generation.

Each of the kits in this roundup is based on an analog-overlay design to put the DVD image on a computer screen. Although this design would be fine for television output, the quality and performance on computer displays could be improved. If you want to watch movies on your computer screen, wait for a kit with an integrated graphics card or one that uses the VGA feature connector to tie the MPEG-decoded image right into the graphics card's buffer memory. Also, most of these kits rely on first-generation DVD drives. Only the Pacific Digital DVD-ROM Kit ($550 street) could read CD-R disks. If you're going to be replacing your CD-ROM with a DVD drive, you'll need to wait a little longer before you can count on the replacement to read everything.

If you want to take the plunge now, however, consider the Diamond Maximum DVD Kit ($400 street). It was easy to install and delivers a wealth of DVD titles. Videophiles might consider the Utobia Hollywood DVD/MPEG-2 AC-3 Playback Kit ($400 street), which delivered the best video playback quality thanks to its Sigma Designs MPEG-2 decoder chip. A scant bundle, poor documentation, and lack of Dolby Digital audio support are the kit's drawbacks.

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COMPAQ

GRAPHIC BY JOE SKUVISUAL LOGIC

Hewlett-Packard, Mitsubishi, Philips, Ricoh, Sony, and Yamaha—broke ranks to create the Phase-Change Rewritable (DVD+RW) specification, which offers a 3GB capacity. And NEC weighed in with its own Multimedia Video File (MMVF) format, with a 5.2GB capacity per side. Although it is too soon to know for certain, it appears that these new specifications are designed so that existing DVD-ROM drives will be able to read both DVD+RW and MMVF disks as if they were standard DVD disks.

And if this weren't enough, Digital Video Express has announced a new format of movie disk for the home entertainment market. The Divx is a one-use disk incompatible with set-top home DVD players, though Divx players will play DVD movies.

Then there is the question of Windows 98. This operating system will reportedly provide system-level support for both DVD drives and decoder cards, besides including software for DVD navigation. But until Windows 98 ships, DVD upgrade kits will have to include manufacturer-provided drivers and software.

ALL-IN-ONE DECODERS COMING, TOO

Perhaps the biggest reason to wait, however, is for the next versions of the decoder cards. There are new decoder chips on the way (such as the DVDPC LS220 from LuxSonor) that integrate all functions on a single chip: MPEG-2 decoding, Dolby Digital decoding, video and audio interface, and even DVD copy-protection support. Some chips (like Chromatic Research's Mpact/3600 media processor chip) are programmable, so features can be added on the fly.

Chips like these will make it easier to integrate the graphics and DVD functions onto a single expansion board that can replace an existing graphics adapter, so you won't need two cards. All the designs in this roundup rely on an *analog-overlay* design, which means that the graphics card has to leave a hole in what it displays to leave a space where the DVD image appears. This requires careful synchronizing of the signals between the DVD decoder card and the existing graphics card. Also, either the graphics signal has to be looped through to the decoder card or the DVD image must be sent across the PCI data bus to the graphics card. Both strategies have performance and quality drawbacks.

Putting all the functions on a single card means that the graphics processor and the decoder can write to the same shared video-buffer memory. This will improve playback image quality and performance. There are even chips that can handle all the decoder and graphics-processing functions, eliminating the need to have different subsystems handled by different chips on the board. The first boards of this type are expected to reach the market by the time this is in print; you can expect to see them in new computer systems first, because they will save a slot for DVD-enabled configurations. As an upgrade, this approach requires the user to replace the graphics adapter, so there may be a longer delay before this type of hardware finds its way into the upgrade market.

In spite of similarities and in some cases the same components, each kit in this roundup has a different set of features and flaws. If you're itching to have the latest technology on your desktop or to create an awesome home-theater installation driven by a PC, you'll find some passable but not perfect candidates among these six. Then all you need is the popcorn, and you can stay home to watch the movies.

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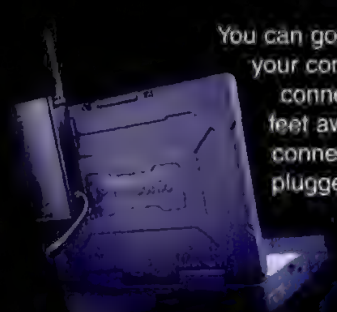

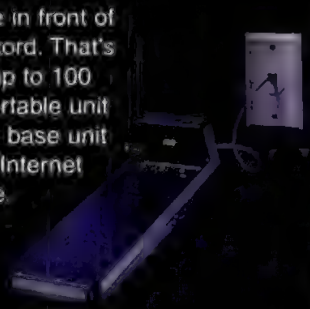

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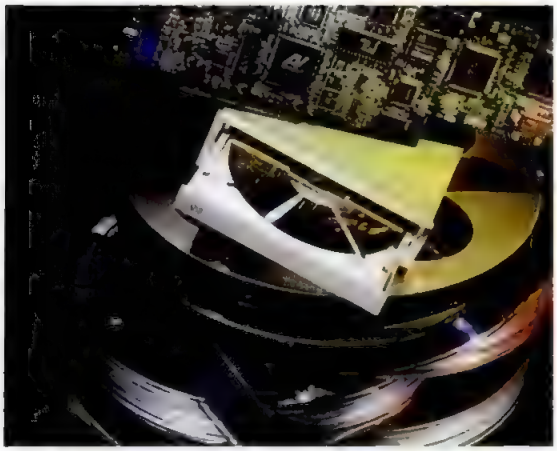
Diamond Maximum DVD Kit

Sporting clever features, a generous software bundle, and a reasonable price ($400 street), the Diamond Maximum DVD Kit offers a lot for a little. Although it has a few shortcomings, it represents a good value among the current crop of competitors.

The package includes the same Toshiba DVD drive used in the Dynatek and Utobia kits in this roundup, and although this first-generation drive can read standard CD-ROMs, CD-R disks are not compatible. The differentiating factor is the Diamond MPEG-2 decoder card. This full-length PCI card has cutouts along the bottom edge to help it clear the CPU heat sinks that block slots on some motherboards. It also has a cleverly perforated blank section at the end of the circuit board, which you can break off if your computer's slot won't accept a full-length card. The kit includes an attractive bundle of games and other DVD titles.



The Diamond Kit is the most recommendable one we tested, with an easy installation and a good software bundle.

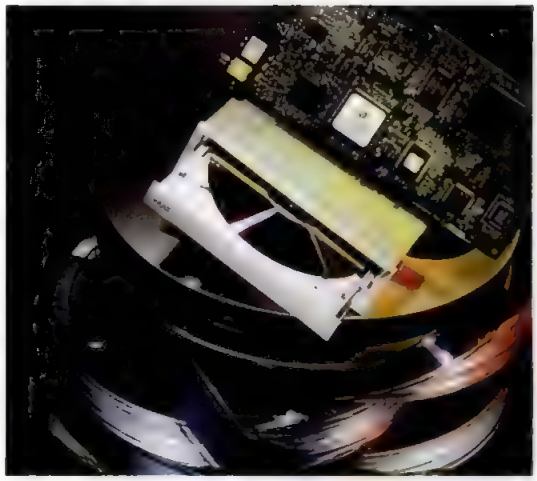
Installation was straightforward and well documented, and the automatic alignment of the analog window worked well. After we adjusted the alignment, however, the auto-adjust function was not able to bring it back to the original settings. Manipulating the DVD navigation software was fairly easy, although the subtitle and language options are only displayed as numbered choices instead of showing the language associated with each number. The slow-motion and single-frame controls are fun additions to the interface.

The decoder board is based on the Auravision decoder chip set for MPEG-2 decoding and, as with the other kits in this roundup, relies on an analog overlay to display DVD images on the computer screen. It uses a VGA pass-through to send the computer image to the card before the image is sent to the monitor. In addition, the card has an internal connection for the DVD drive's stereo output (for audio CDs) as well as a stereo line output to plug into your computer's sound card.

Playback on a computer monitor showed numerous aliasing artifacts, but motion was smooth with no apparent "combing" effects. The 16:9 window image appeared slightly squashed at the automatic settings but looked better when viewed full-screen—although the full-screen image leaves the Windows title bar visible at the top, detracting from the image.

Although playback could be better and the interface has a few flaws, the Maximum DVD Kit remains one of the more attractive bundles in this group. Its affordable price makes it all the more tempting for those who need DVD now.—*Alfred Poor*

Diamond Maximum DVD Kit. Street price: $400. Diamond Multimedia Systems, San Jose, CA; 800-468-5846, 213-933-4959; www.diamondmm.com. *Circle 441 on reader service card.*



The Dynatek upgrade kit was an able performer but slightly pricier than the competition.

Dynatek DVD-471TII Upgrade Kit

Easy to install and bundled with attractive software titles, the Dynatek DVD-471TII PC Upgrade Kit ($560 street) is a mid-priced offering aimed at home users and PC enthusiasts. Performance and playback amply kept pace with the competition.

The kit is built around Toshiba's first-generation drive, which cannot read CD-R disks. Installing the hardware and loading the driver and player software took no longer than 15 minutes. The manual is comprehensive, with pictures and easy-to-follow instructions. The kit includes a Quadrant International PCI MPEG-2 decoder card and six movie, game, and reference titles.

When we ran the video signal over the PCI bus to our graphics adapter, we experienced ragged video and excessive artifacts during movies. For much cleaner playback, either hook the card up to an external TV or get a pass-through cable for your graphics adapter. With a pass-through cable—or the decoder's direct S-Video or composite output—the picture was clearer than with the best VHS decks. Sound quality was excellent in stereo, and it approached theater quality when using a Dolby Digital receiver and compatible speakers.

The Dynatek is a good buy if you want a robust, quality home-theater kit that comes with a few titles to start off the family DVD library.—*James Karney*

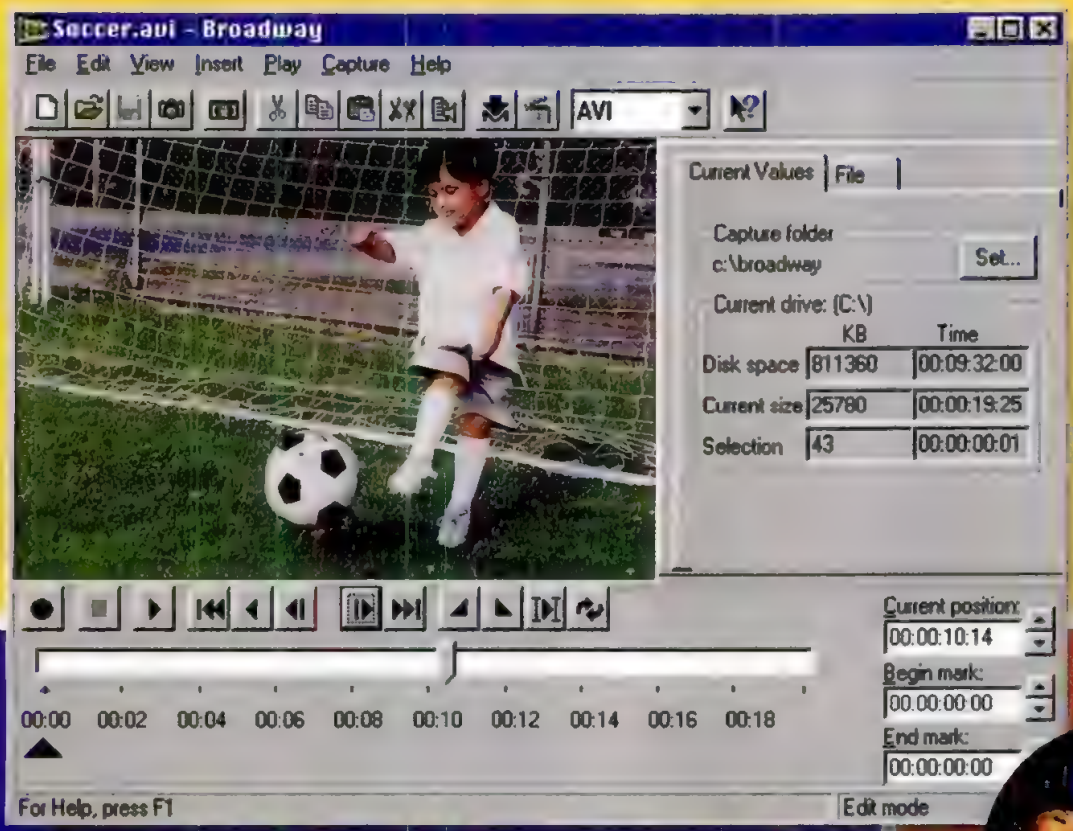
Dynatek DVD-471TII Upgrade Kit. Street price: $560. Dynatek Automation Systems, Bedford, NS, Canada; 800-461-0052, 902-832-3000; www.dynatek.ca. *Circle 442 on reader service card.*

HiVal DVD Entertainment Solution Kit

The HiVal DVD Entertainment Solution Kit ($700 street) clearly beats the competition in terms of packing the most product into the box. Filled with software titles and advanced hardware options, the HiVal kit brings a lot to the table for its top-of-the-line price.

The package includes all the usual kinds of items: a Toshiba DVD IDE drive, a Quadrant International MPEG-2 decoder board, drivers, DVD player software, and a manual. The kit includes seven cables (IDE and various audio/video styles), a WaveCom Sr. wire-

WOW! Even I can do that.



Chris W. from Boston took several video clips from her son's soccer games and edited them into a single video with exciting effects and music.

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***Fortune*, May 26, 1997**

"The release of Netscape Communicator 4.0 ushers in an exciting new era for corporations, end users, and applications developers alike. Just as the advent of business productivity suites changed the face of the software market, so should Communicator (and soon, IE 4.0) change the way corporations do business both internally and externally."

***PC Magazine*, August 1997**

"All in all, Navigator 4.0 is the best Web browser available today."

***Wall Street Journal*, July 10, 1997**

"Unlike Microsoft's Webcaster push technology, Netscape's Netcaster uses existing standards such as HTML, Java and JavaScript."

***InfoWorld*, June 2, 1997**

"But there's further cause for celebration. For instance, Communicator 4.01 consumes about 3 MB of RAM less than Navigator 3.0."

***C/Net*, July 10, 1997**

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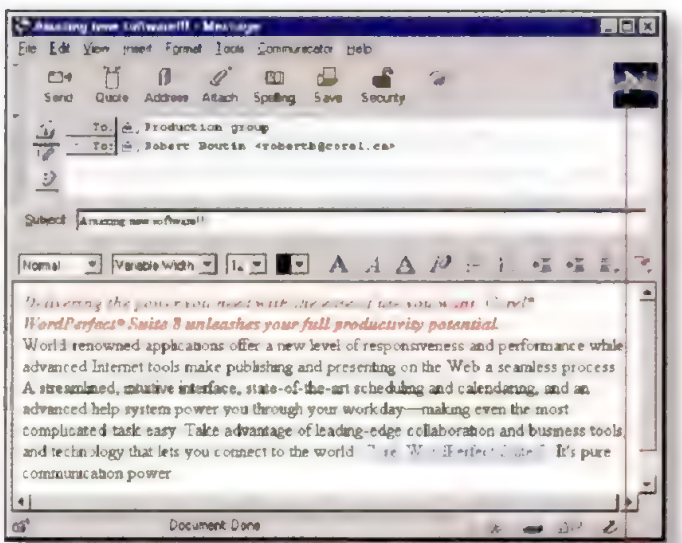

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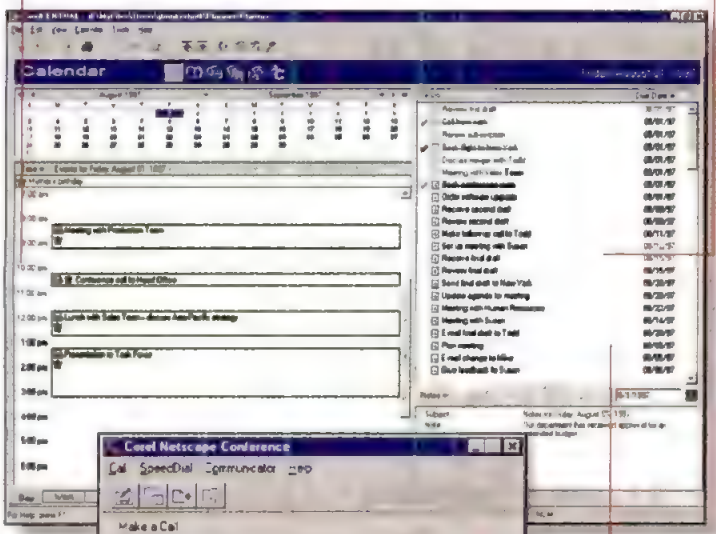

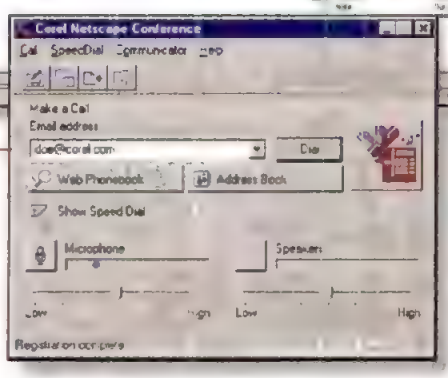

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DVD Titles: BETTER GAMES, MORE DATA

Just because new-fangled features are available to DVD developers doesn't mean that title developers are actually taking advantage of them. To gauge how new titles leverage the benefits of the DVD platform, we loaded up five first-generation DVD titles for the PC. These early titles run the gamut from simple multi–CD-ROM disk consolidations to titles illuminating the future promise of DVD-ROM. In every instance, the benefits of DVD shine through. Whether this is due to the enhanced video quality, the faster access speed, or the simple convenience of not having to flip multiple CD-ROMs to access additional data, once you've experienced a DVD-ROM title you'll find it hard to go back to CD-ROM.

Blockbuster Entertainment Guide includes movie clips, reviews, and bios of major stars.

Creative Multimedia's **Blockbuster Entertainment Guide to Movies and Videos** ($29.95) tracks over 23,000 movies and is an invaluable resource for selecting the perfect evening rental or tracking down an elusive bit of movie trivia. Each movie record contains a succinct plot summary, a star rating (on a scale of 1 to 5), and a cast list. More than half also include more detailed reviews from London's *Time Out Film Guide*. In addition to a keyword search for movie title, cast, and crew, you can search by category, MPAA rating, or nationality, and you can restrict your search by release date and star rating.

From a media perspective, the Guide contains over 5,500 photographs representing actors, actresses, and movie scenes but only a disappointing 50 video clips. Also on the disk is a list of 65 years of Academy Award winners and approximately 10,000 short biographies.

The Guide is a converted CD-ROM title, and the most obvious DVD enhancement was the conversion of the 50 movie excerpts from MPEG-1 to MPEG-2 format, which delivers a better-quality image. Video playback was impressive, but with over 2.5GB unused capacity on the disk, we would have liked to have seen more video clips.

Covering over 60,000 albums from 4,000 artists, Creative Multimedia's **Billboard Music Guide** ($39.95) is a dream come true for audiophiles and music trivia buffs, and even less fanatical listeners will find a lot to like in this title.

The Music Guide's flexible search engine lets you search by music category, album, song title, and artist, with substantial cross-referencing among the categories. Artist biographies contain complete lists of albums and are peppered with reviews, photos, short music clips, and a sprinkling of music videos.

The Music Guide contains over 2,000 compressed MPEG-1 audio clips and 72 MPEG-2 videos of artists like Hendrix, Bowie, the Grateful Dead, and Widespread Panic, totaling a little over 2GB of data. The quality of the video and particularly the audio clips is very good, but once again we wish there were more of them. (Creative Multimedia, Portland, OR; 800-262-7668, 503-241-4351; www.creativemm.com. *Circle 480 on reader service card.*)

The Learning Company's **Genius of Edison** (only in DVD bundles; not sold separately) is invaluable for students studying Thomas Edison's work and enjoyable for anyone with even a casual interest in one of America's most prolific inventors. Genius chronicles Edison's 13 primary inventions from three viewpoints: "Tom's Technology" uses text, audio, animation, and video to explain the technology underlying the invention; the "Daily Edisonian" contains press releases and articles describing the public's response to the new invention; and the video "Time Marches On," illustrates how the technology is used today. In addition, a database contains over 200 articles covering ancillary topics of the day, from Barnum and Bailey's Circus to the Remington typewriter.

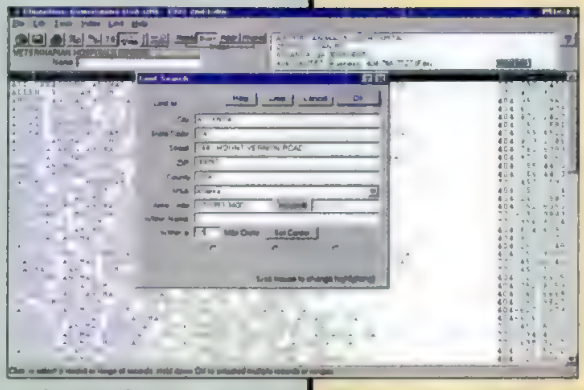
Billboard Music Guide has something for everyone in an eminently searchable format.

By concentrating on 13 inventions, Genius lavishes each topic with meaningful multimedia, including 46 MPEG video files, 99 QuickTime movies, and over 100 audio files, totaling just under 2GB of data. Where many titles deliver more raw data, most spread their multimedia content

LOTS OF VIDEO

more thinly, making it seem random or even gratuitous. Genius proves that even with DVD real estate, there's a lot to be said for focus. (The Learning Company Inc., Cambridge, MA; 800-227-5609, 617-494-1200; www.learningco.com. *Circle 481 on reader service card.*)

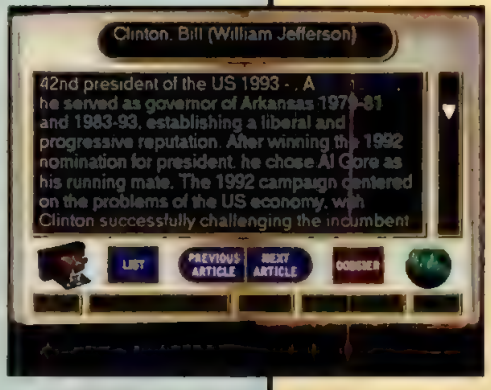
With over 112 million business and residential listings, American Business Information's **PhoneDisc PowerFinder USA One** ($100) is an essential tool for businesses needing lists for direct mail, telemarketing, or direct sales. PhoneDisc is also handy if you call directory assistance frequently, especially if many of your calls are out of state.



With PhoneDisc on DVD you can stop shuffling the six disks the CD versions needs.

You can search by name, business type, street, or phone number, and you can restrict output by address or geographical distance. For example, you can create a list of names and phone numbers for residences on a particular street, or you can locate all the veterinarians within 15 miles of downtown Atlanta. You can then export your list into several database formats, including Symantec ACT! and Lotus Organizer, as well as Lotus Word Pro and Microsoft Word mail-merge formats.

A consolidation of a six–CD-ROM set, the DVD PowerFinder saves you the hassle of flipping disks to complete your search, and it runs at lightning speed. You can also run the title directly from the DVD-ROM drive without installing any files on your hard disk. (American Business Information Inc., Bethesda, MD; 800-284-8353, 402-593-4500; www.phonedisc.com. *Circle 482 on reader service card.*)



Encyclopedia Electronica gets an A for multimedia content but a C for its interface.

In Tsunami Media's **Silent Steel** ($49.95), the Cold War is back. You're the captain of a nuclear ballistic missile, trading sonar kisses with Libyan and Russian nukes with unknown intentions. Talk about dangerous liaisons! Included in this DVD are 4 hours of video and more than 30 potential endings.

More "intelligent motion picture" than interactive game, the disk has a user interface consisting of short, full-screen video clips followed by three text alternatives presented under the video. Your responses to the various scenarios determine your ultimate success or failure.

A consolidation of four CD-ROMs, Silent Steel benefits from the upgraded quality of the MPEG-2 video, which showcases the beautifully shot footage. Tsunami also provides multilanguage support via English, French, and German menus and subtitles. Although fast-twitch gamers will likely be frustrated by the game's structured approach, Steel is a flashy poster child for DVD's potential for video-intensive interactive games. (Tsunami Media, Oakhurst, CA; 209-683-8266; www.tsunamimedia.com. *Circle 483 on reader service card.*)

One of the few products designed exclusively for DVD, Xiphias's **Encyclopedia Electronica** ($65) is chock-full of high-quality multimedia content. The only negative is a cumbersome interface that limits the usability of most of the text-based data.

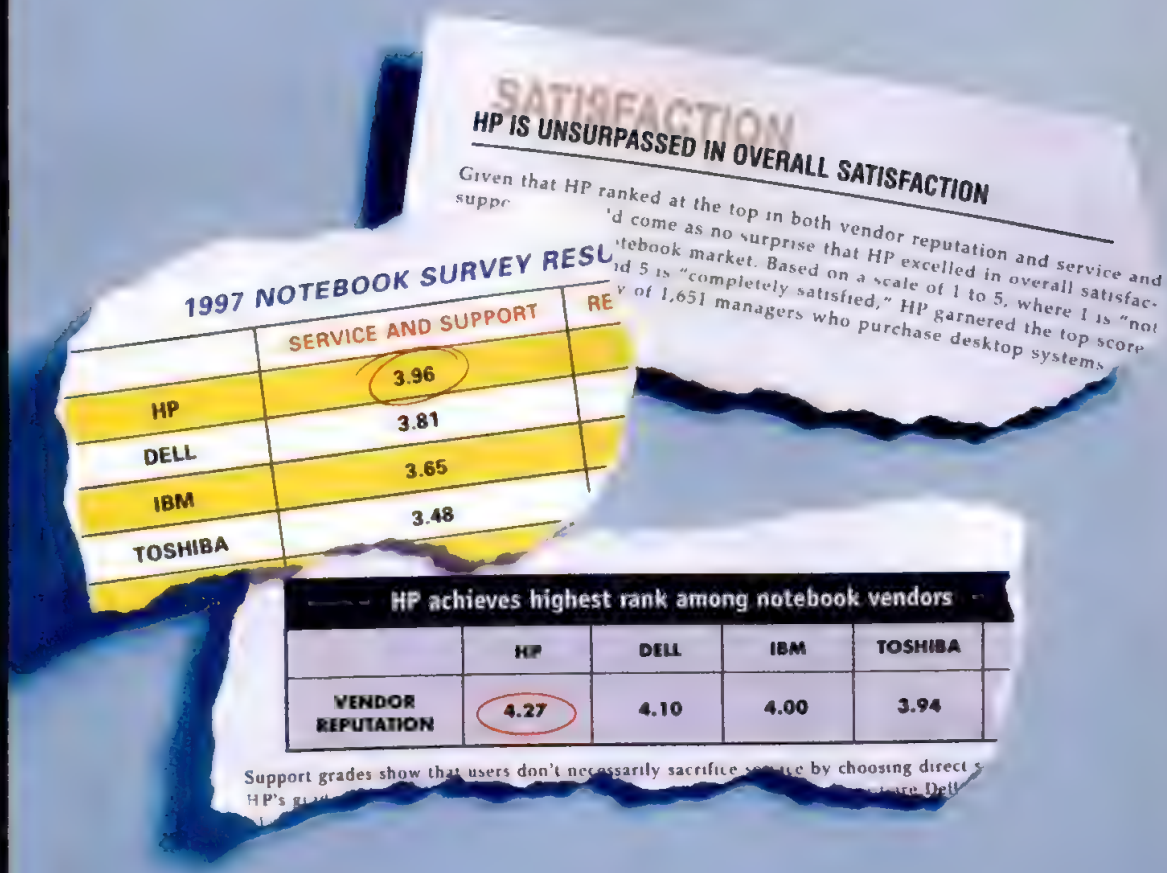
The Encyclopedia contains over 25,000 articles and 15,000 stories derived from previous Xiphias CD-ROMs. In addition to 80 minutes of MPEG-2 video and over 8,400 still images, Encyclopedia Electronica debuts a new still-image format called GeoSphere, which provides 360-degree views of selected sites such as Stonehenge and Cape Canaveral.

You search for information through four separate views, including a time line, media browser, and test search, assisted by audio help. While searching, you can collect a dossier of records relevant to your search topic.

Designed for both desktop and convergence PC/TV computers, Encyclopedian Electronica's interface is dominated by oversize icons and large-font text that can be easily read from across the living room. The unfortunate result is a simplistic interface that displays frustratingly small amounts of information. Although the Encyclopedia provides unparalleled quantities of high-quality multimedia content, its interface limits the attractiveness of the package. (Xiphias Corp., Los Angeles; 310-841-2790. *Circle 483 on reader service card.*)—*Jan Ozer*

Bells, whistles and a little something

to silence the competition.



You've decided what you want in a notebook. But before you decide which one to get, consider that in a recent customer survey by *Computerworld*, HP was ranked at the top in overall satisfaction among 1,651 IT buyers of notebook computers. Perhaps that's because HP's entire family of OmniBooks was unsurpassed in the survey when it came to service and support, vendor comfort and reputation. Couple that with the fact that HP scored significantly above average in every other category in the survey, and a certain something begins to ring true. From the value-priced OmniBook 2000, to the lightweight 800 model, HP is being recognized as a leader in notebook computing across the board. Well, that certainly sounds like loud praise indeed.

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The HiVal kit includes a wireless transmitter/receiver system so you can play DVD on a TV in another room.

less transmitter/receiver (for sending the DVD feed to a remote TV), an A/B switch to change between TV and DVD operations, an IR receiver, and six game and educational titles. HiVal also sells an economy kit without the wireless peripherals and associated cables for a street price of $500, which is right in line with other kits in this roundup.

Installing the drive, card, and software was a snap. Both hardware components are Plug and Play, so once we rebooted the machine, everything was up and running. Setting up the wireless connection was more of a challenge, however, partly because of the confusing user manual. The wireless connection is a nice touch, especially if you want to watch DVD movies in a separate room away from your PC. The only drawback is WaveCom's lack of a Dolby Digital jack: The IR units have only video and standard RCA audio jacks. The card itself has S-Video, mini-stereo–out, and RCA composite video–out on the rear plate, along with CD-ROM–in and CD-ROM–out internal connections. About the only other cable the company could have possibly included would have been a video pass-through for the PC's graphics adapter.

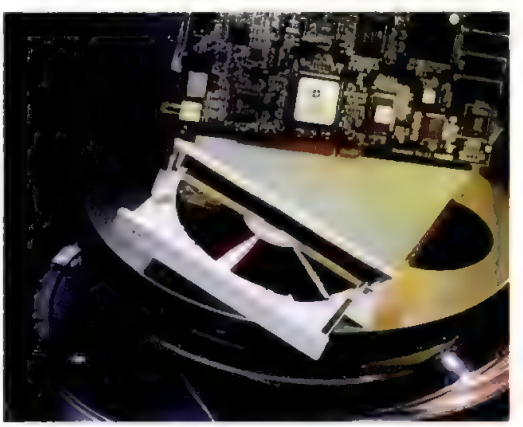
As with all the kits shipping with Quadrant International cards, on-screen video is very choppy if you run the signal over the PCI bus to the display card and out to the monitor. We hooked the card up via the S-Video on our graphics adapter with excellent results. Output to a TV monitor was also free of the combing effects, choppiness, and jaggies seen without the pass-through arrangement on the monitor. Sound quality was on the mark with regular PC stereo speakers and excellent with a top-quality Dolby Digital receiver.

If you're looking for a DVD upgrade kit that won't send you running to the local electronics store looking for a cable during installation, this is probably the one to buy.—*JK*

HiVal DVD Entertainment Solution Kit. Street price: $700. HiVal Inc., Santa Ana, CA; 714-953-3000; www.hival.com. *Circle 443 on reader service card.*

Pacific Digital DVD-ROM Kit

At first glance, Pacific Digital Corp.'s PDC DVD-ROM Kit ($550 street) looks just like the other bundles in this roundup. It comes with a Quadrant International MPEG-2 decoder card, an IDE DVD drive, cables, software, and a detailed installation manual. What sets it apart is its Hitachi GD-2000 drive, which is the first second-generation DVD drive to hit the market. The capabilities of the Hitachi drive make this the only unit we tested that can access all types of 650MB disks—including CD-R platters. The unit also reads DVD-ROM disks at twice the speed of earlier models.



The PDC Kit includes a Hitachi DVD-ROM drive—the only one in this roundup that can read (some) CD-R disks.

Installing the card and player under Windows 95 is painless: Simply place the board in a free PCI slot, attach the Hitachi GD-2000 to your system's IDE interface, and load the driver when prompted. We had the first movie on-screen in less than 10 minutes. As with all the kits that use the Quadrant card, direct monitor playback over the computer's PCI bus was very ragged and showed combing artifacts. Attaching the kit to the graphics adapter with a pass-through or video-in connection will yield a much better picture.

When we piped the data directly through the card's S-Video and composite outputs, we achieved an image quality superior to that of any VHS. Images captured from the DVD disk were clean and without distortion. Sound quality was good on quality stereo PC speakers and excellent when played through a Dolby Digital receiver.

If you need to read both DVD and CD-R disks and want a drive that will handle both tasks, the Pacific Digital kit has a decided advantage. Its ease of use and good performance make it worthy of serious consideration.—*JK*

PDC DVD-ROM Kit. Street price: $550. Pacific Digital Corp., Irvine, CA; 714-252-1111; www.pacificdigitalcorp.com. *Circle 444 on reader service card.*

techmedia DVD-ROM Drive

A bare-bones kit, the techmedia DVD-ROM Drive ($400 street) is aimed at the budget-minded user who wants DVD without paying for any extras.

The bundle includes a Pioneer IDE DVD-ROM drive, a Quadrant PCI decoder card, thorough documentation, and two sampler DVD disks. The tray-style drive has convenient CD-ROM–style controls for track forward/backward, along with dual LED lights that indicate whether a CD or a DVD is loaded.

Even the most nontechnical PC owner should be able to add the drive and the card just by following the detailed instructions and drawings in the manual. The card and drive are Windows 95 Plug and Play–compliant; we had the bundle installed in less than 15 minutes, including the time it took to reboot the system.

The decoder card can be used either via your PC's graphics adapter and moni-

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PERFORMANCE TESTS

DVD-ROM Drives

PC MAGAZINE LABS

Our testing showed little difference among the kits we reviewed in our DVD roundup—not a surprising result, given that almost all of the kits use the same Toshiba drive.

What the Numbers Mean

The timings on our DVD-ROM Read test fell within a narrow range for these six drives, with only 2 seconds separating the fastest from the slowest—a negligible amount. The winner by this narrow margin was the only Hitachi drive, provided in the Pacific Digital DVD-ROM Kit. It took only 38.2 seconds for the drive to transfer our 50MB file. The four Toshiba drives in the kits we tested showed nearly identical times; the differences fall within the margin of error for our tests.

Since most users will also use their DVD drives for CD-ROM access, we also ran our standard CD-ROM Sequential Read test. Here, the Hitachi drive in the Pacific Digital kit pulled ahead by a more substantial margin. Rated at a maximum 16X in CD-ROM mode, it transferred 1,440 KBps (kilobytes per second), versus approximately 1,200 KBps for the competing drives, which are rated at 8X for CD-ROMs. The Hitachi drive was also the only one that could read CD-R disks, a feat that all future DVD-ROM drives should be able to accomplish.

At the present time, the raw performance differences among drives in DVD kits is very small. The main buying choices hinge on price, bundled software titles, and (for some users) the ability to read CD-R media.

How We Tested

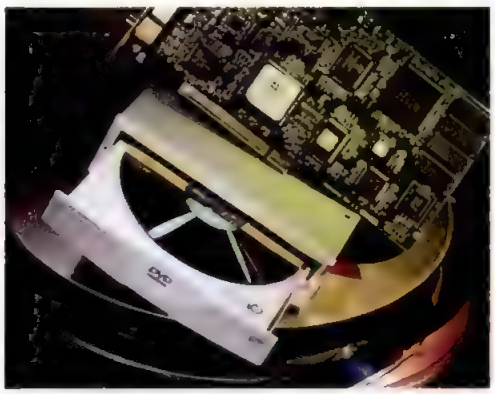
The **DVD-ROM Read** test measures the time it takes for a drive to transfer a 50MB file using the XCOPY32 command. We ran the test three times, and we present the average timing for each unit.

The **CD-ROM Sequential Read** test measures the drive's raw data throughput rate when transferring sequential data from a CD-ROM disk. We ran the test three times, and we present the average throughput for each unit.

The **CD-R Compatibility** test indicates whether the drive is able to read most compact disk–recordable disks.

We tested using a Micron Millennia Pentium/200 with 32MB of RAM, a 2.1GB Western Digital Caviar hard disk, and an ATI All-in-Wonder graphics adapter. For Dolby Digital playback we used a Yamaha RX-V2092 receiver, and to compare video playback quality we used a Toshiba SD-3107 home DVD player.
—Analysis written by James Kearny

Bold type denotes first place	DVD-ROM Read Seconds	CD-ROM Sequential Read KBps	CD-R Compatibility
Diamond Maximum DVD Kit	39.6	1,210	Fail
Dynatek DVD-471TII Upgrade Kit	40.2	622	Fail
HiVal DVD Entertainment Solution Kit	40.1	1,210	Fail
Pacific Digital DVD-ROM Kit	**38.2**	**1,440**	Pass
techmedia DVD-ROM Drive	39.4	1,200	Fail
Utobia Hollywood DVD Playback Kit	39.6	1,210	Fail
	◀ BETTER	BETTER ▶	



The techmedia kit is a functional, affordable DVD solution, but don't expect bells and whistles.

tor or by hooking up the board directly to a TV set or monitor. If you want quality video playback, get a pass-through cable (we wish one were included) to bypass the PCI-graphics card interface. Running the signal over the PCI bus to a graphics adapter yields a choppy image with jagged-edged artifacts. On a TV screen, video images looked better than VHS, and stereo sound was excellent. Adding a Dolby Digital receiver and matching speakers to the system will have your neighbors wanting tickets to the movie or concert.

Like other first-generation drives, the Pioneer drive cannot read CD-R disks. But for most users, the techmedia kit has all the basics for entering the realm of DVD video from the PC. It may lack some of the cables and extra software that compelling kits deliver, but you aren't charged for them either.—*JK*

techmedia DVD-ROM Drive. Street price: $400. techmedia Computer Systems, Garden Grove, CA; 800-379-0077, 714-379-6677; www.techmedia.net. *Circle 445 on reader service card.*

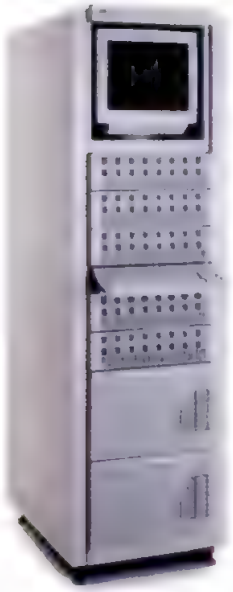
Utobia Hollywood DVD/MPEG-2 AC-3 Playback Kit

Utobia Corp.'s Hollywood DVD/MPEG-2 AC-3 Playback Kit ($400 street) distinguishes itself by its excellent computer screen output, beating the competition in sheer image quality. Unfortunately, this success is offset by a number of weak points in the product's bundle.

First and foremost, Utobia merely assembles the component parts of the kit and resells them under its own name. This is most evident in the fact that there are separate pieces of documentation covering the installations of the Sigma Designs MPEG decoder card and the Toshiba DVD drive; there is no single manual describing the package or how to get it to work. Novices may find the setup process intimidating. The software bundle is also slim; the only disk included contains the Warner Hollywood Studio Movie Trailer DVD and Warner Music Groups DVD Video samplers.

The half-length PCI expansion card, based on Sigma Designs' fine RealMagic MPEG-2 decoder chip, uses an external pass-through for the VGA signal and an analog overlay design to show DVD images on the computer screen. The card

NEW PRODUCT



intel inside
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SUMMARY OF FEATURES See www.pcmag.com for interactive views

DVD Upgrade Kits

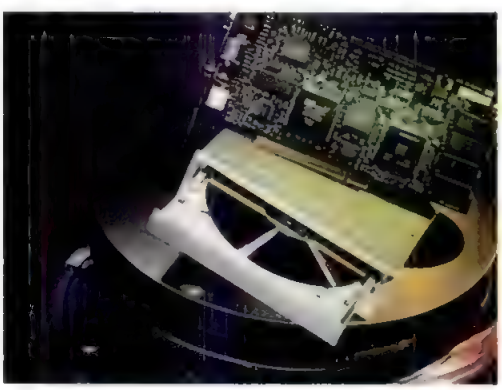
■ YES ▫ NO
Products listed in alphabetical order

	Diamond Maximum DVD Kit	Dynatek DVD-471TII Upgrade Kit	HiVal DVD Entertainment Solution Kit	Pacific Digital DVD-ROM Kit	techmedia DVD-ROM Drive	Utobia Hollywood DVD/MPEG-2 AC-3 Playback Kit
Street price	$400	$560	$700	$550	$400	$400
Drive manufacturer and model	Toshiba SD-M1002	Toshiba SD-M1002	Toshiba DVD-1002	Hitachi GD-2000	Pioneer DVD-101	Toshiba SC-M1002
Rated average access time: DVD/CD-ROM	200 ms/130 ms	200 ms/130 ms	140 ms/110 ms	210 ms/130 ms	200 ms/150 ms	220 ms/120 ms
Rated CD-ROM speed	8X	8X	8X	16X (variable)	8X	8X
DVD Adapter Card						
Manufacturer	Diamond Multimedia Systems	Quadrant International	Quadrant International	Quadrant International	Quadrant International	Sigma Designs
Model	DVD 2000	Cinemaster	Cinemaster	Cinemaster	Cinemaster 2.3	RealMagic Hollywood
MPEG-2 decoder chip set	Toshiba	SGS Thompson	SGS Thompson	SGS Thompson	SGS Thompson	Sigma Designs
Dolby Digital decoder chip set	Zoran	SGS Thompson	SGS Thompson	Zoran	SGS Thompson	Sigma Designs
Delivers analog movie window on computer monitor	■	■	■	■	■	■
VGA loop-through	■	■	■	■	■	■
Video Output						
Analog stereo	■	■	■	■	■	■
Dolby Pro Logic	■	■	■	■	■	■
Dolby Digital sound (SP/DIF)	■	■	■	■	■	■
Composite video	■	■	■	■	■	■
S-Video	■	■	■	■	■	■
Software and Support						
Drivers for Windows 3.x	■	■	■	■	■	■
Drivers for Windows 95	■	■	■	■	■	■
Drivers for Windows NT	■	■	■	■	■	■
Drivers for OS/2	■	■	■	■	■	■
DVD titles in bundle	Encyclopedia Electronica, Spycraft, Warner Hollywood Studio Movie Trailer DVD Sampler, Warner Music Groups DVD Video Sampler, Wing Commander IV	Daedalus Encounter, Encyclopedia Electronica, Muppet Treasure Island, Silent Steel, Spy Craft, Wing Commander IV	Daedalus Encounter, Encyclopedia Electronica, Muppet Treasure Island, Serengeti Encounter, Silent Steel, Spy Craft, Wing Commander IV	Muppet Treasure Island, Sprynet Internet Connect, Spy Craft, Truman DVD Movie, Warner Hollywood Studio Movie Trailer DVD Sampler, Warner Music Groups DVD Video Sampler	Warner Hollywood Studio Movie Trailer DVD Sampler, Warner Music Groups DVD Video Sampler	Warner Hollywood Studio Movie Trailer DVD Sampler, Warner Music Groups DVD Video Sampler
Warranty	1 year	1 year	1 year	1 year	1 year	1 year
Toll-free technical support	■	■	■	■	■	■
Technical-support hours	8:00–8:00 M–Sat	8:00–8:00 M–F	8:00–6:00 M–F	8:30–5:30 M–F	8:00–6:00 M–F	8:00–5:30 M–F
Web site	www.diamondmm.com	www.dynatek.ca	www.hival.com	www.pacificdigitalcorp.com	www.techmedia.net	www.utobiadvd.com

also has outputs for composite video and S-Video, but there is no output for Dolby Digital sound. After you install the card and software, you have to run an automatic configuration routine that adjusts the timing of the analog-overlay window.

DVD control software is uneven. There is a Next Track button, but there is no easy way to jump to any track on the disk as you can with other player applets. You can choose either a full-screen display or a window in which to display the image. It is easy to select subtitles and dialog choices by language, but subtitles are unfortunately superimposed on the image, even when you're viewing a 16:9 image in letterbox format.

During our tests, the video-image quality was excellent. There were no obvious artifacts on the computer screen during playback of DVD content, and motion was swift and smooth. In fact, this was the best of the bunch for viewing movies on the computer.



The Utobia Hollywood kit is a mixed bag: great video but poor documentation and software.

The Hollywood kit gets a mixed score. Good image quality and a competitive price are offset by skimpy documentation and only two bundled titles. The lack of Dolby Digital output will diminish its appeal for an all-out home-theater installation. In the end, it is an acceptable but not compelling choice.—*AP*

Hollywood DVD/MPEG-2 AC-3 Playback Kit. Street price: $400. Utobia Corp., City of Industry, CA; 888-488-6242; www.utobiadvd.com. *Circle 446 on reader service card.* PC

There are over 2 million miles of paved road in the United States.

So many roads. So little time. That's the feeling you get behind the wheel of the Dodge Stratus ES–an intelligently designed sedan that was specifically engineered to make driving more of what it should be–fun.

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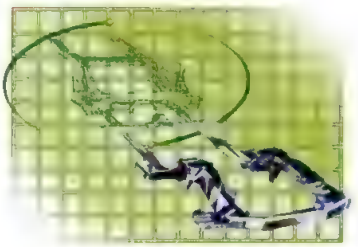
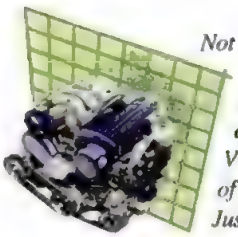
By incorporating steel rails and crossmembers, we developed an extremely rigid unibody that minimizes flexing and twisting to provide a solid foundation



for Stratus' modified double-wishbone suspension. The result is a smooth ride with firm, responsive handling. Your daily commute may never be the same.



Not only does Stratus look like it can perform, it backs it up with an available 2.5L, 24-valve V-6 that delivers plenty of power on demand. Just say when.

This race-modified Stratus was developed largely in-house and was the first American-built car to compete in the North American Touring Car Championship. Obviously, our designers and engineers know a thing or two about performance. We think you'll agree. To find out more about Stratus, call 1-800-4-A-DODGE or visit our Web site at www.4adodge.com

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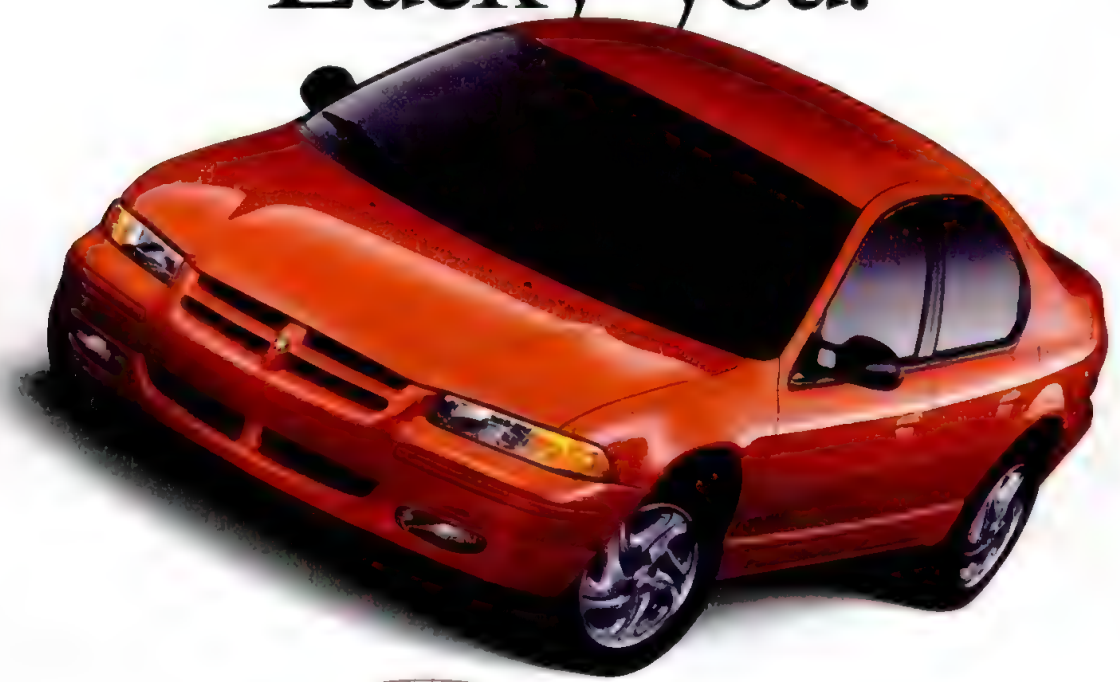

Stratus The New Dodge

Always use seat belts. Remember a backseat is the safest place for children.

WEB DATABASE DEVELOPMENT TOOLS

from the ground UP

By Richard V. Dragan

Build a new life for your company's legacy client/server databases. Construct a Web-based application with one of these six packages.

In this review

Borland IntraBuilder Client/Server 1.5 210
Microsoft Visual InterDev 1.0 215
Netscape Visual JavaScript 1.0 (beta) 224
Oracle Web Developer Suite 1.1 228
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Suitability to Task 210
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Ah, the more things change.... Not long ago, client/server databases on the corporate LAN were all the rage. Now, with the arrival of the Internet and the ascendancy of intranets, you might think that the thousands of client/server database systems created in the last ten years are endangered. But not so fast—the results of our tests may surprise you.

webdbdialog.com

Attention, developers! Get your two cents in on whether to code or not to code. Join Rich Dragan online November 10–14 to discuss these packages.

ILLUSTRATION BY KIP HENRIE

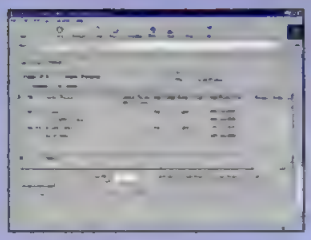
Database Access Methods

Today's Web database development tools offer several strategies for accessing a corporate database from within a browser. Web-enabled RAD solutions run in your browser via plug-ins or ActiveX controls; HTML mixed with ActiveX or Java is the most typical approach to database design; and pure HTML provides an extremely thin client. Some tools offer you the choice of deploying your applications using any of these options.

CLIENT SERVER

RAD Tools Model

In this solution, RAD tool forms can be displayed inside a browser using plug-ins such as PowerBuilder 5.0 or ActiveX controls such as Visual Basic 5.0. The client accesses the database directly, so users need database drivers in addition to the plug-ins or controls, resulting in a much fatter client than with other approaches.

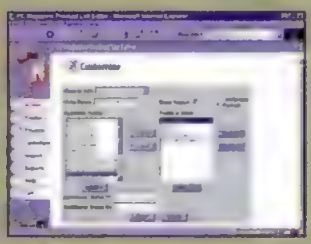


Browser

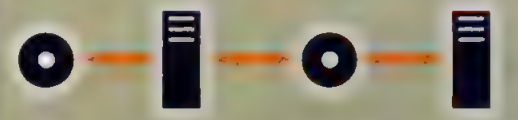
The Web server and the database function essentially independently of each other. Some products use pooled database connections to attempt to improve server-side performance.

Mixed-Components Model

Here, the server renders the look and feel of the interface in HTML and forms built using ActiveX or Java components, or a combination. No database drivers are needed, but users do need to download some components, creating a moderately chubby client. A disadvantage of this method is that not all browsers support different components.



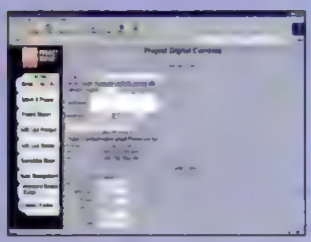
Browser



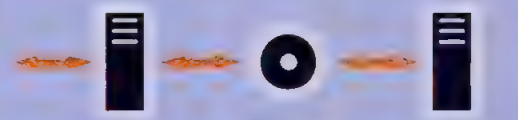
As the browser requests pages, the Web server can access the database through a variety of means, including CGI, Microsoft Active Server Pages (ASP), or Java. Some products offer middleware that makes the process more efficient by coordinating transactions.

Pure HTML Model

This approach offers the widest access for Web users and the thinnest client. The server creates the user interface in standard HTML, JavaScript, or both. In the current roundup, Microsoft, Netscape, and Oracle offered this option.



Browser



The Web server conducts all interaction between the client and the database; again, middleware may be used to improve the efficiency of transactions. The server employs CGI scripts, ASP, or Java to generate HTML based on information from the database.

Just over a year ago ("Web Database Tools," September 9, 1996), traditional client/server tool vendors had barely entered the Web-enabled marketplace, and the tools we reviewed were either simple kludges or complex, code-intensive exercises that still did not provide full-featured applications. But vendors have created new products that by and large negotiate the transition to the Web successfully.

You can build any type of Web application with these products, but we focused on creating applications for corporate intranets and porting legacy database applications to them. IS managers aren't likely to throw out an old code base, experience with a vendor's tools, and the years of development effort they represent.

We therefore evaluated tools from the major database vendors—Borland, Microsoft, Oracle, and Sybase—all of which have offered client/server tools in the past. We tied Netscape Visual JavaScript into an Informix database; Informix does not yet have a RAD (rapid applications development) tool. We invited IBM but could not include VisualAge in the main roundup because we required that applications run in the major browsers shipping during our testing: Microsoft Internet Explorer 3.0, Netscape Communicator, and Netscape Navigator 3.0. IBM insisted on running its application in the only fully JDK 1.1–compliant browser shipping during our testing period, Sun's HotJava.

We also invited last year's Editors' Choice winners—NetDynamics 4.0, from NetDynamics Inc., and WebObjects Enterprise, from Apple (formerly from NeXT)—to see just how far the market has evolved and how these tools compete against their client/server brethren. NetDynamics did not have a public version in time for testing, but we looked at an upcoming release (for more information, see the sidebar "Preview: NetDynamics 4.0").

To test these vendors' tools and evaluate their capabilities, we selected a real-world database application used at PC

Our Contributors: RICHARD V. DRAGAN is a programmer at PC Magazine Labs. GREG ALWANG is a contributing editor of *PC Magazine*. TODD E. COLUMB and HEATH H. HEREL are consultants at Walker Systems Support, a computer management and support firm. JOSHUA KERIEVSKY is the founder of Industrial Logic, a company specializing in Java and Web development. JAY MUNRO was the project leader, and DAVID LIDSKY was the associate editor in charge of this story.

Magazine Labs and asked the vendors to enable it for the Web. The results of this experiment in system reengineering were promising, demonstrating that you can take several roads to bring that dinosaur system to the corporate intranet.

If you're in a hurry, traditional client/server tools, such as Sybase's PowerBuilder Enterprise 5.0 and Microsoft Visual Basic 5.0, can let traditional applications run inside a browser almost effortlessly. Unfortunately, because interaction with the database takes place on the client, the user is saddled with a much fatter client than with other solutions. This may not be a problem on intranets, where IS departments have better control of what hardware and software a user needs.

Still, thin-client computing is where the corporate intranet can really shine. The benefit for the user is that nothing (or very little) must be installed on the client—the only necessity is the proper Web browser for the solution chosen. Mobile users can work on the road. Applications can be upgraded without a user's knowledge, downloading on the fly. This alone is a huge win for most companies, where client installations and upgrades can take considerable time and expense. In large organizations, the same thin-client application can run across different hardware platforms without IS staff having to write and maintain different versions.

Most important, by divvying up the work between the client and the server sides, IS departments can take advantage of cutting-edge thinking about systems architecture, such as *application partitioning*. Here, the business rules and database access are left to the server rather than the client, resulting in easier maintenance and access to distributed computing. If your company has somehow avoided this multitiered strategy, then the move to an intranet will likely make it worth your while to redesign your applications.

Editors' Choice

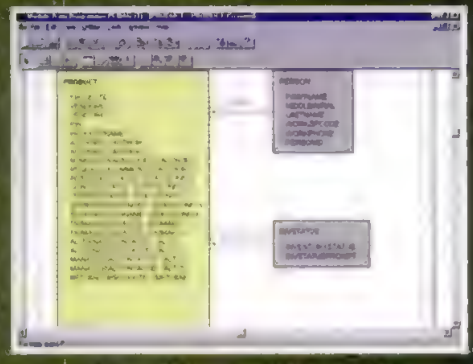
Oracle Web Developer Suite 1.1

With all the power, flexibility, scalability, and richness of tools that an experienced developer needs to build serious applications for the Web, Oracle Web Developer Suite 1.1 earns our Editors' Choice award.

The Web Developer Suite has everything you need to build an enterprise-strength Web application from the ground up: The Designer/2000 and Developer/2000 tools help you build applications, and a collection of servers, including Oracle Web Application Server and Oracle 7.3 database server, let you deploy them.

Oracle's suite offers the most advanced tools to build applications. For example, Designer/2000, which lets you create your business logic, does most of the coding for you. Creating forms is a matter of dragging and dropping and connecting fields. Designer also lets you reverse-engineer database tables, views, constraints, and indexes from any ODBC database, making the redesign of preexisting client/server applications to the Web that much easier regardless of which database you have used or plan on using.

With Developer/2000, you can edit and debug the applications you build in Designer. Developer also contains Object Navigator, the best object browser we saw in this roundup. Object Navigator let us access every level of our application and edit and tweak as needed.



A well-deserved honorable mention goes to Microsoft Visual InterDev 1.0, a tool particularly useful for team applications development. You can use wizards to generate much of your application, including the layout, navigation controls, and database connections, but to create more advanced features you'll have to do some coding.

THIN AND THINNER

We saw two thin-client approaches in this roundup. Some vendors offer component-based solutions—with either Java, Microsoft ActiveX, or both—mixed with HTML on the client. This strategy lets you achieve richer interfaces, powered by Java (or JavaBeans) and ActiveX, that are closer to what users have come to expect from years of traditional client/server computing. Unfortunately, not all browsers support Java or ActiveX—a problem with Java in particular, where the differences between JDK 1.0 and JDK 1.1 may require a specific browser for the client. Again, this is not likely to be a problem for corporate intranets, but it could make expansion to an extranet difficult.

Currently, Java-based solutions offer no local file access. None of the products in this roundup could import files using Java, one of our test requirements. This will certainly change as security choices in Java implementations mature. And in general, the printing and reporting capabilities of these solutions were not as rich as with traditional client/server applications. This too should improve with time.

For the thinnest client of all, pure HTML is the way to go—especially if the application will be seen by users on an extranet or by the public. Here, HTML is created dynamically on the server, being served out of the corporate database.

Regardless of the path taken, we found the functionality of these Web applications to be surprisingly rich and, with very few exceptions (such as Java-based local file access and printing and reporting) to be comparable with their traditional client/server predecessors. If you've been holding off on bringing a client/server application to the Web, you really have no reason to hold up delivering an up-to-the-minute Web-based version.

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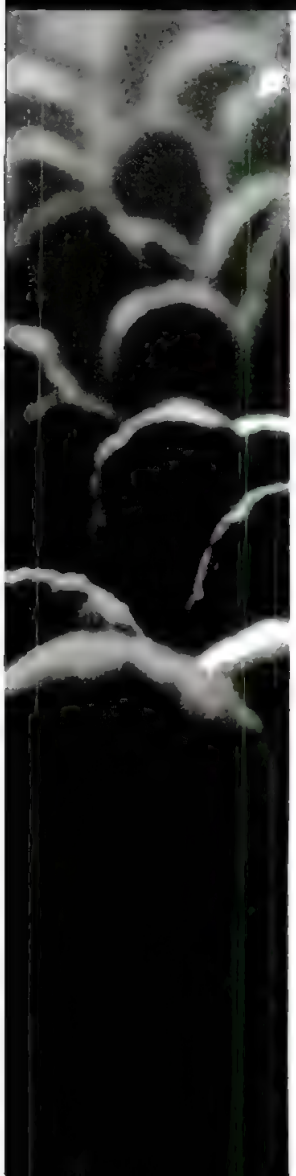

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Suitability to Task: Web Database Development Tools

	Borland IntraBuilder Client/Server 1.5	Microsoft Visual InterDev 1.0	Netscape Visual JavaScript 1.0	Oracle Web Developer Suite 1.1	PowerBuilder Enterprise 5.0	WebObjects Enterprise 3.1
POWER						
Interface development	Good	Good	Fair	Excellent	Good	Good
Database connectivity	Good	Excellent	Fair	Excellent	Fair	Excellent
Deployment	Good	Excellent	Poor	Excellent	Good	Excellent
EASE OF USE						
Interface development	Excellent	Excellent	Fair	Excellent	Good	Fair
Database connectivity	Excellent	Excellent	Fair	Excellent	Fair	Excellent
Deployment	Good	Excellent	Poor	Good	Fair	Good

Interface development We look at how difficult it is to create the interface for our test application. In addition, we look at how much RAD-tool functionality is included as well as the variety of reusable components—HTML, JavaBeans, ActiveX components, or a combination. Are there wizards to automate creating database-aware forms? Is there a rich tool set for designing, debugging, and deploying the interface? How difficult is it to access the server-side components during development?

Database connectivity Here we rate the database abilities of each project. Are there tools or wizards for creating and managing a database? We also consider how tightly integrated this product is with one or more database solutions. Is it tied to one vendor's database, or does it offer a more open database solution—through ODBC, for example? Can it get at advanced SQL capabilities (triggers and remote procedures)? Products that offer advanced database capabilities such as transaction management score higher here.

Deployment The ability to deploy different versions of the same application (in pure HTML, HTML/Java, or ActiveX hybrid, and in pure Java) is the primary concern here. We also look at tools for publishing, deploying, and maintaining the finished application. Are there publishing wizards, or do you have to upload your files yourself? Are there tools to package the client if it needs ActiveX, Java, or libraries? Can you maintain the application and database remotely—for example, by debugging and tracing code on the server? Can the application be easily documented (through Java pages), and how easily can help be attached for the end user?

Borland International Inc.

Borland IntraBuilder Client/Server

In IntraBuilder Client/Server 1.5, Borland has created a true RAD tool for the Web, rather than a Web-enabled traditional client/server development solution such as Sybase's PowerBuilder or last year's Delphi Client/Server Suite.

IntraBuilder offers a scalable, high-performance application server for creating multitier Web applications. It supports several Web servers, most major databases, and all HTML standards, and it incorporates Borland's enhanced server-side JavaScript capabilities.

Though IntraBuilder is a solid product overall, the lack of some features, such as a debugger, workgroup functionality, and good support for third-party tools, makes IntraBuilder a less robust solution than Microsoft's or Oracle's.

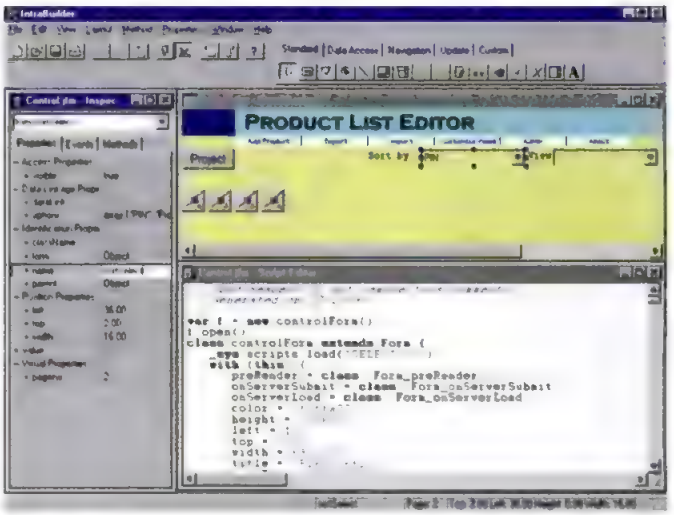
Borland offers IntraBuilder in three versions: Standard, Professional, and Client/Server. We looked at the high-end Client/Server edition, which features greater scalability and better database support than the other two.

Because IntraBuilder applications generate pure HTML code—as with Microsoft InterDev's design-time ActiveX controls—they can run in any browser on any platform. This tool also supports client-side JavaScript for JavaScript-aware browsers. IntraBuilder will automatically determine how much JavaScript to send to the client, but the developer can choose to override it and force the application not to export JavaScript, thereby offering a true thin client.

IntraBuilder's wizards, called Experts, are a wonderful aid for quickly generating data forms, home pages, and reports. You can easily create a data form with support for queries and filters by checking two boxes during the forms Expert process.

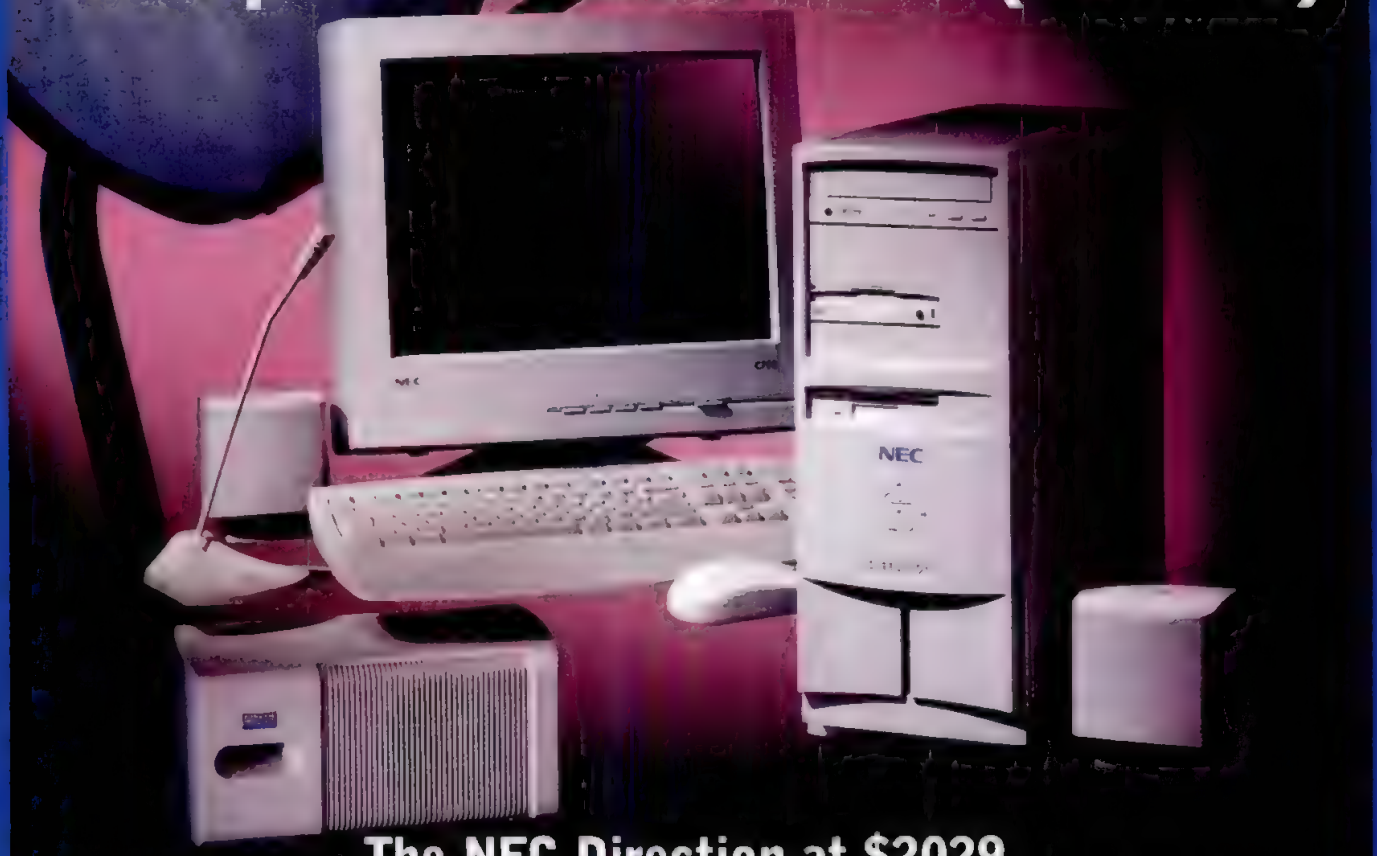
Using Borland's Two-Way-Tools, you can switch between visual designing and JavaScript as needed (though the SQL Builder is not a Two-Way-Tool in Version 1.5 of the client/server edition). The Two-Way-Tools for creating HTML forms and manipulating databases visually are well integrated and intuitive. Included in the client/server version is the data migration Expert, which lets you move a database (both schema and content) quickly and easily between different servers.

IntraBuilder uses JavaScript with custom Borland extensions to add new classes, exception handlers, and methods, making JavaScript programming that



The Two-Way-Tools available in IntraBuilder let you work visually or directly with code. Here you can also see the properties box for the selected object.

The technology is circa 2000. The price is circa 2029. (Dollars)



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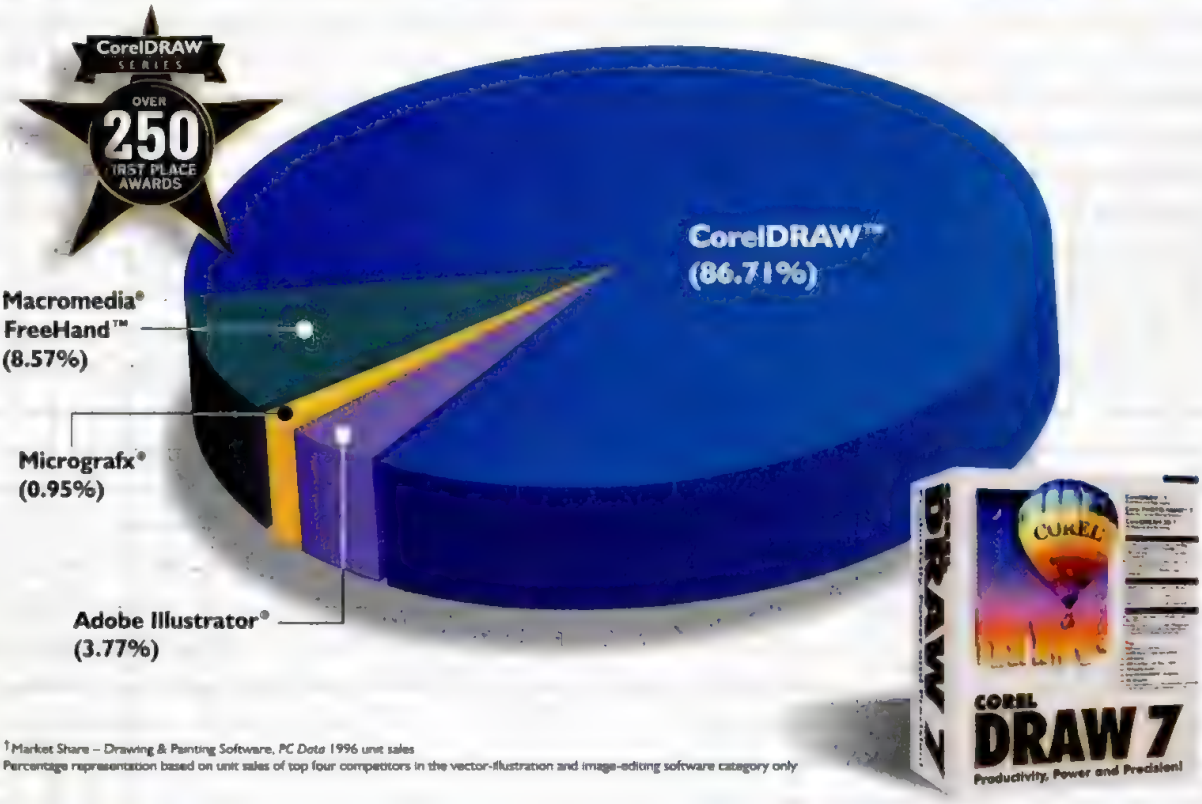

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much easier. Compared with Microsoft InterDev, IntraBuilder lets you use its visual tools much longer before having to resort to writing code. When creating our search screens with multiple list boxes, we did the majority of the work visually, then we added linking code to update the second list box based on the user's selection in the first.

Although there is no script debugger in Version 1.5, IntraBuilder does include ScriptPad, which lets you type JavaScript commands and immediately see the results in a separate pane. This tool is useful for debugging because it lets you try a command and see the output.

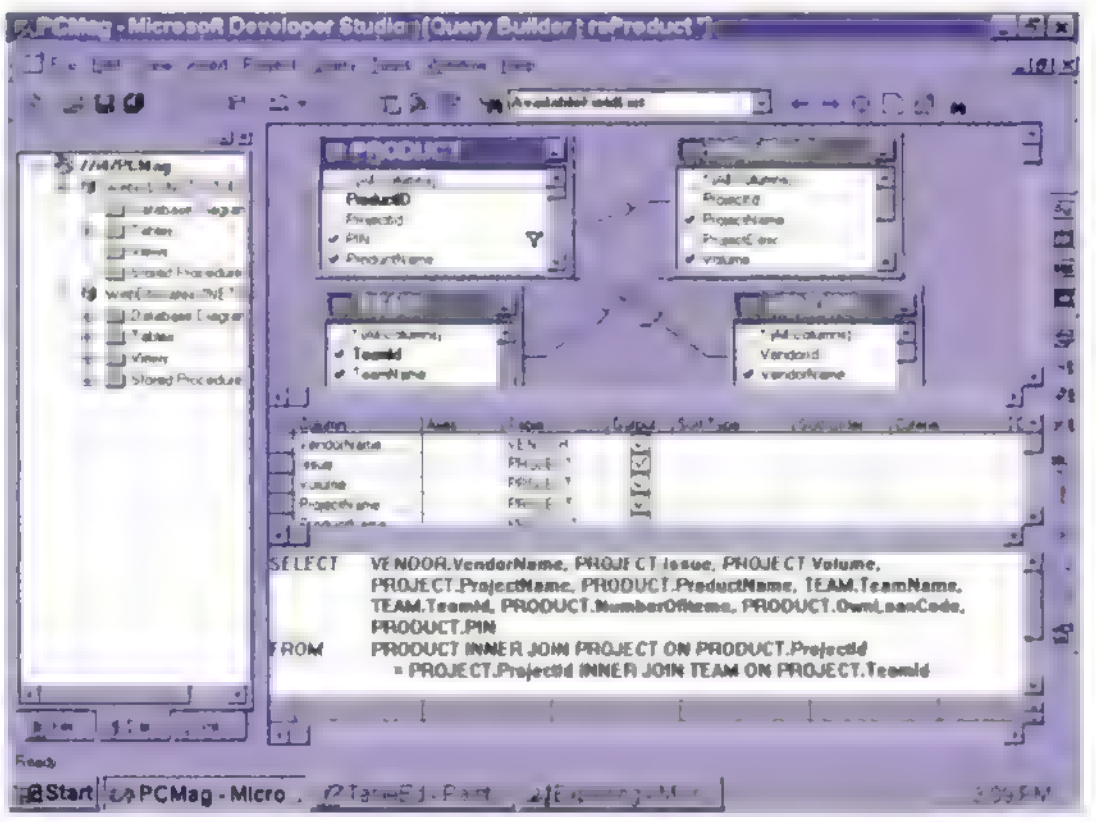
As with the other products in this roundup, IntraBuilder does not perform syntax checking: Your code must be entered correctly because JavaScript is a case-sensitive language. Unfortunately, IntraBuilder lacks built-in support for workgroups and file sharing, but you can use external source-control systems.

When creating forms, you must use the integrated form designer in order to access the properties, events, and methods needed for IntraBuilder. The included Netscape Navigator Gold lets you browse a page while working on it, so you can quickly see how changes will appear. You'll need to use this approach because a few of the Java events don't work when viewed within the integrated development environment (IDE).

The Visual Property Builder displays a dialog box with the properties of all HTML 2.0 tags. This is convenient for inexperienced HTML authors. The form designer also incorporates the useful "master page" concept used in desktop publishing applications: The server includes any objects or text placed on the master page on every page. This feature lets you easily create a consistent look and feel for your application.

You can add prebuilt custom components to a page simply by dragging them from the Component Palette. The ability to add any custom component to the palette makes creating your application even faster because you can reuse code and objects.

IntraBuilder Client/Server supports scalability by using multiple remote IntraBuilder Agents to spread the workload among several servers. The IntraBuilder Broker included in all three editions routes requests from browsers to an available IntraBuilder Agent. IntraBuilder Professional can use multiple local agents, while the basic edition can use only a single local agent. Performance enhancements made to Version 1.5 include faster forms rendering by the agents and connections to relational databases using the new Borland Database Engine, Version 4.0.



In Microsoft Visual InterDev, the Query Builder tool lets you create a complex SQL query visually and show the actual SQL statement immediately.

The IntraBuilder server includes several behind-the-scenes functions that make building your application even simpler. IntraBuilder supports nine different image formats—more than most browsers support—but the server will automatically convert images to a format each recipient browser can handle. Errors generated by the server now call a default page named ERROR.HTM. You can customize this page for your application and even include JavaScript to provide more details to the user, based on the actual error number.

Borland IntraBuilder, though not as polished as other products in this roundup, is a good, reliable solution for Web database development.—*Todd E. Columb*

Borland IntraBuilder Client/Server 1.5. Street price: $1,995; upgrade, free for current customers. Borland International Inc., Scotts Valley, CA; 800-233-2444; www.borland.com. *Circle 448 on reader service card.*

Microsoft Corp.

Microsoft Visual InterDev

Designed to let teams of programmers and nonprogrammers work together on a Web database project using a single integrated development environment, Microsoft Visual InterDev 1.0 easily meets its goals. A team can quickly create a business solution for your intranet or the Internet using this superb product, which features Visual SQL database management, source-control features, and design-time ActiveX controls.

InterDev is still a young product, however, and it lacks some of the features that more mature products such as Oracle Web Developer Suite and WebObjects Enterprise offer, such as Web Developer Suite's multiple-application targeting and WebObjects' debugging tools. In addition, Visual InterDev requires an Active Server Pages–capable Web server, meaning that you must use IIS or O'Reilly's WebSite 2.0 for your Web server or the ChiliSoft ASP plug-in for other servers.

The Developer Studio IDE provides a common environment for InterDev's development tools. Built-in team capabilities, site management, and database and content-editing tools make InterDev a welcome addition to any developer's toolkit.

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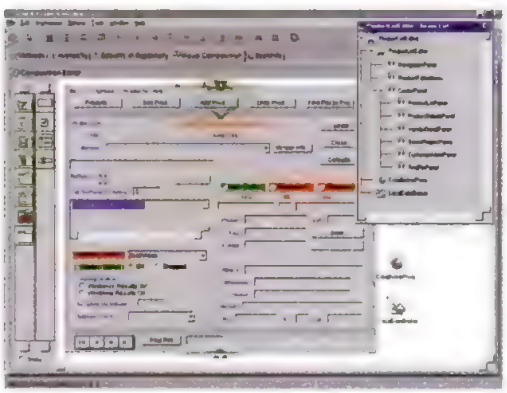
IBM VisualAge for Java 1.0

IBM designed its VisualAge (VA) family of development tools to let you visually connect the disparate parts of an application instead of writing code. The newest addition, VisualAge for Java 1.0, lets you easily wire together components to create Java applications, applets, and Java-Beans.

IBM declined our invitation to participate in a comparative roundup, because our PC Magazine Labs testers asked that vendors create an application to run in either Microsoft Internet Explorer or Netscape Navigator, the browsers that make up more than 90 percent of the Web browser market. VA for Java requires a browser that is compliant with the JDK 1.1 (Java Development Kit) for full feature support, and at the time of our testing, Sun's HotJava was the only shipping browser that supported the JDK 1.1. Both IE and Navigator, however, should support the JDK 1.1.3 by the time you read this.

VA for Java comes in several editions. The entry-level package is free for download and limited to 100 Java classes; the $99 Professional Edition provides all the basic tools for developing Java applications; and the $1,995 Enterprise Edition includes additional tools for developing distributed client/server applications.

Serious Java developers will find that VA for Java's well-designed graphical interface and powerful visual tools provide an ideal programming environment. You can view and organize your project and its packages, classes, and methods from the Workbench window. A handy Hierarchy view shows class hierarchies, the methods for each class, and the source code for each method. The source code window in the Hierarchy view doubles as a source code editor.



The Visual Composition Editor lets you define the connections between your application objects visually.

Experienced Java developers will applaud the Visual Composition Editor, which you use to connect JavaBeans with events. The integrated debugger lets you set break points, change code on the fly, and resume execution. VA for Java recompiles code changes instantly and dynamically reflows the changes to the running applet, making the debugging process truly interactive.

Useful tools abound in VA for Java, such as a sophisticated, pop-up search utility that lets you search classes or packages or entire projects. The Beans List, accessible via a right-mouse-click menu, gives you quick access to any JavaBeans that make up a given package. A BeanInfo viewer lets you define additional properties for the Beans.

VA for Java tracks versions of classes, packages, and entire projects automatically and even lets you reinstate and recompile an earlier version of any element. IBM plans to realize this movement toward team-based development in an Enterprise Edition release slated for the end of this year.

The Enterprise Edition uses the JDK's Remote Method Invocation (RMI) for communicating between the client and the server. The Remote Method Invocation Builder tool assists with the creation of server-side methods and lets you create a customized middle tier that supports high-end capabilities such as dynamic partitioning. The Remote Object Instance Manager is a shell for controlling instances of Java classes and is useful for prototyping and testing your distributed applications. All in all, this package is certainly worth tracking. —*Greg Alwang*

VisualAge for Java 1.0 Enterprise Edition. List price: $1,995. IBM Corp., Armonk, NY; 800-426-3333; www.ibm.com. *Circle 454 on reader service card.*

implementing complex forms. In our sample application, for example, we added code to create complex search forms that allow a user to select items from a list box to update the contents of a second list box, whose chosen items update yet another.

Design-time ActiveX controls, introduced with Visual InterDev, provide all the benefits of components, but they have no runtime component and generate pure HTML code. You can easily extend the IDE with these design-time ActiveX controls and with third-party wizards.

InterDev eliminates nearly all Website maintenance and staging headaches with one-button publishing and other features such as the ability to copy and move entire sites. During the development process, you can create or modify a site stored on a Microsoft Personal Web Server for Windows 95 (included with InterDev). When you're done, you can copy the entire site to your production server running Microsoft Internet Information Server (bundled with Windows NT Server). InterDev's Link View option presents the developer with a graphical representation of the application, including links, broken links, multimedia files, database connections, and even executable files.

Applications created with InterDev can access ODBC-compliant products from Microsoft, Oracle, Sybase, and others. For faster execution, you can connect to a Microsoft SQL Server database using a native driver. You can access all other databases via standard 32-bit ODBC drivers.

The visual database tools provided with InterDev offer so much power that you may want to use InterDev for database management alone. For example,

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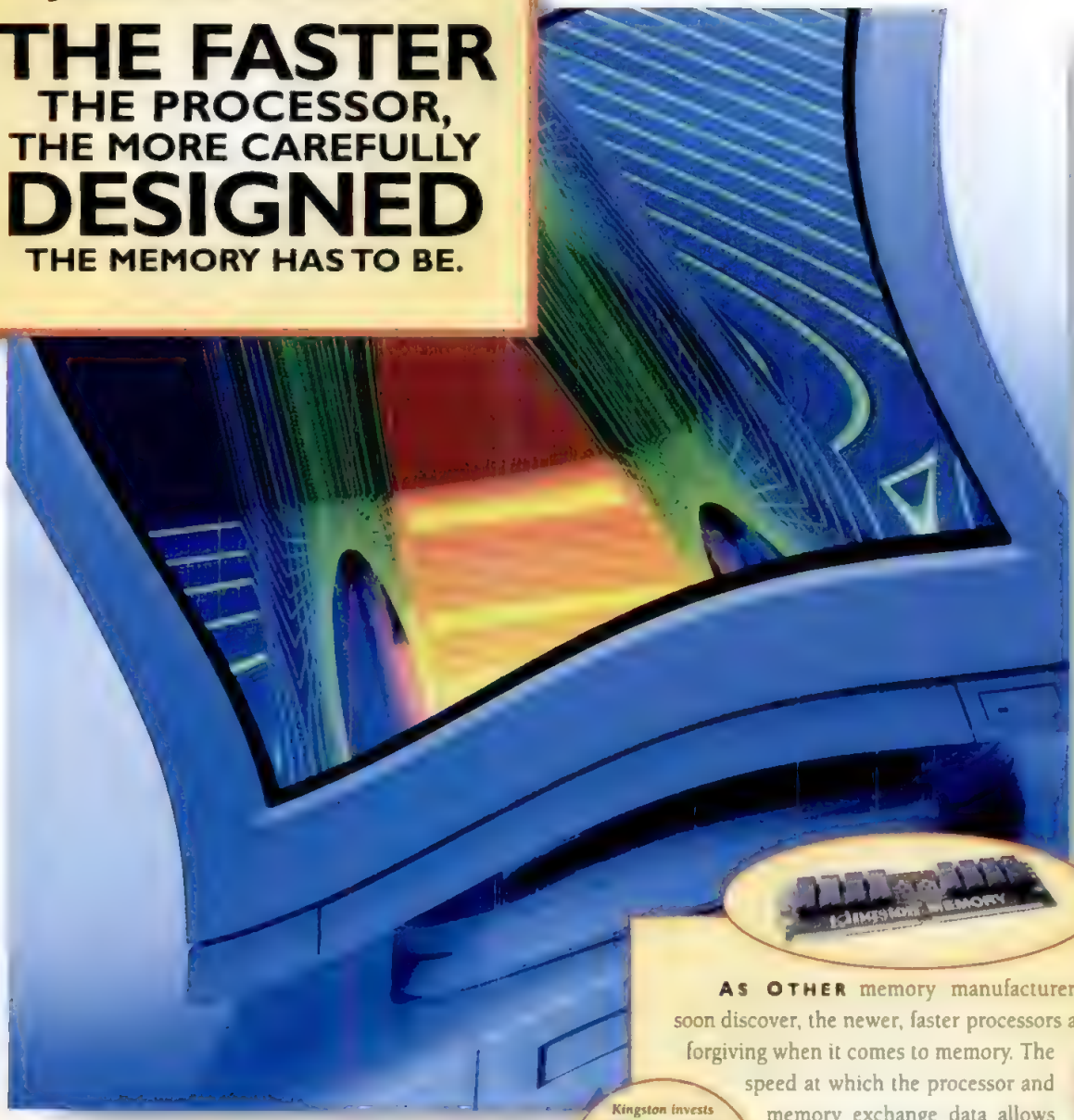

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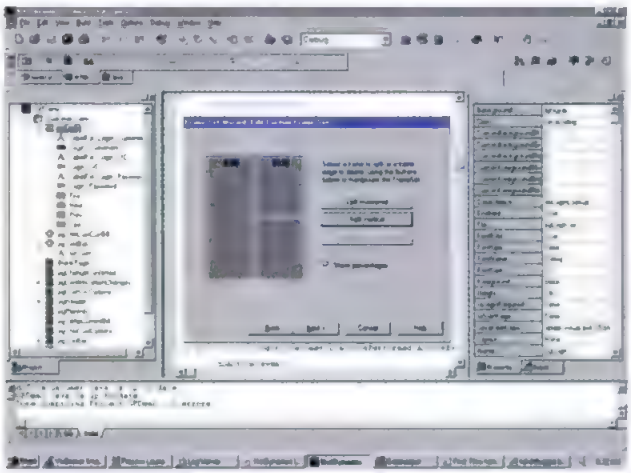
Preview: NetDynamics 4.0

NetDynamics has not rested on its laurels since winning our Editors' Choice last year for NetDynamics 2.0 ("Web Database Tools," September 9, 1996). Rather, NetDynamics has completely overhauled its feature-rich flagship product in an effort to provide an even more robust enterprise development platform that supports open standards. We looked at a prerelease version of NetDynamics 4.0 (planned to ship by the fourth quarter), which has been designed from the ground up to integrate with any database, any client, and any Java development tool.

Version 4.0 offers improvements on the NetDynamics visual Developer Studio, a built-in Java debugger, hooks to source code control tools, support for the new JDK 1.1 standard, a console manager, and a highly extensible application server framework.



The Frame Set Wizard makes creating frames pages as easy as slice-and-dice.

Compliant with both the CORBA specification and JDK 1.1, NetDynamics produces more efficient applications using less Java code. Support for the Source Code Control API, PVCS, and the JDK Debugger API is included. The optimized data access component, called the Data Server, supports Oracle, Informix, Sybase, DB/2, PeopleSoft, SAP, and any ODBC-compliant database.

NetDynamics' Developer Studio RAD tool has wizards for creating any design element, from HTML frames to Java applets. New in Version 4.0 is the ability to generate an application using strictly HTML, Java, or a combination of both. The slick Frameset Wizard lets you quickly create framed pages containing HTML or JavaBeans. You can design Java components as Java dialogs that float over the browser window when activated. The new JavaBean Editor (JBE) lets you edit JavaBeans created with NetDynamics or any other Java development tool, such as Symantec's Visual Café.

For serious Java developers, NetDynamics provides built-in "event adapters" that point to JDK events and create the Java stub code. This eliminates the tedious step of writing code to open and connect to objects and saves significant development time for those who plan to extend NetDynamics applications through Java.

Version 4.0 includes a powerful new Java applet debugger service, based on the JDK 1.1 Debugger API. The service can debug both client-side and server-side Java and comes with an intelligent, context-sensitive Java code editor, which assists with code writing.

NetDynamics offers extremely flexible scalability. The multithreaded Catalyst Application Server architecture consists of several CORBA services, each of which monitors the others to find the most efficient path for processing database requests. This lets you scale and fine-tune your application to many different levels.

The bundled console utility, Command Center, graphically monitors the performance of your application and its services, much like Microsoft Windows NT's Performance Monitor. For fault tolerance, you can configure NetDynamics to restart services or defer to cloned services if they are interrupted.—*Greg Alwang*

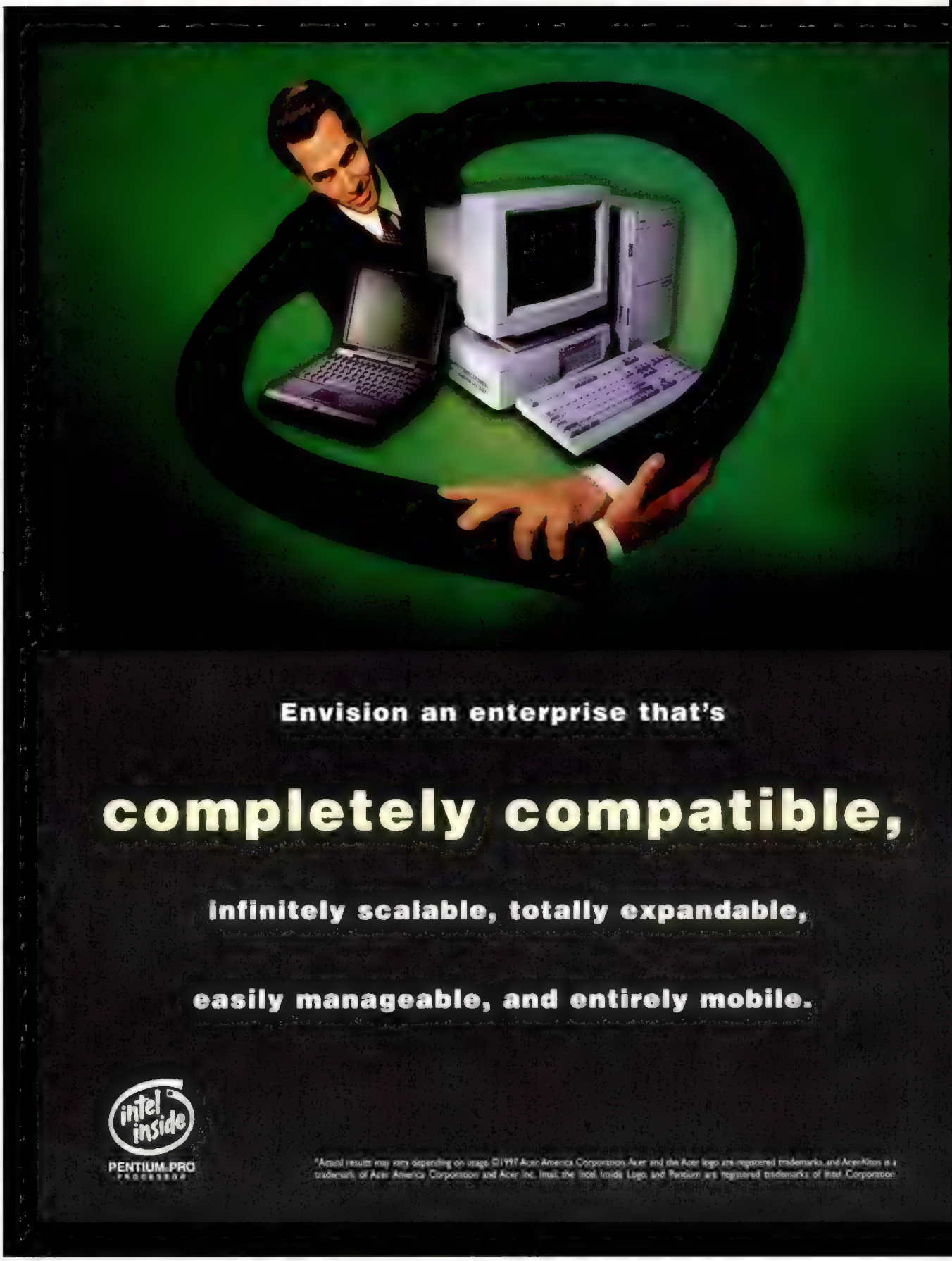
NetDynamics 4.0 (private beta). NetDynamics Inc., Menlo Park, CA; 650-462-7600; www.netdynamics.com. *Circle 455 on reader service card.*

you can drag and drop tables, diagram the relationships between them, select sort order, and enter data for *where* clauses.

InterDev creates all the scripts required for your application. When you visually change a field's data type, InterDev generates all the appropriate SQL script to copy the data, drop the table, create a new table, and import the data. If you change a key field, InterDev creates the scripts needed to change the field in all tables that reference that key field. InterDev can also create new tables, fields, triggers, and even stored procedures. If you don't have rights to make changes to the database, you can save the script and submit it to the database administrator for review and implementation.

The security features available when creating your application stem primarily from the Web server, database server, and operating system. Using either source control or Windows NT, file permissions access to your critical business logic can be restricted to a select group of programmers even while nonprogrammers have access to work on HTML documents. For OS-level security, you will need to use Microsoft Windows NT Server or Windows NT Workstation 4.0 with an NTFS partition as your development platform. This is typical of other products, but InterDev provides tighter integration with Windows NT than others do.

For you to benefit from version control, revision tracking, and file check-in/check-out capabilities, InterDev requires Visual SourceSafe 5.0 (not included). But even without source control, InterDev handles conflicts gracefully by checking date/time stamps, allowing you to choose between using your local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copy or accessing the master copy. When modifying a file, InterDev copies it from the Web site and stores it locally, using standard HTTP—allowing for content to be published through firewalls. While developing our sample application, the Microsoft team did not use SourceSafe, so we saw firsthand the benefits of InterDev's built-in date/time checking without full version control.

Microsoft Visual InterDev 1.0 provides the ease of use and power of comparable tools available last year. Strong team development support, extensibility, and server-side scalability make InterDev a great choice for many developers. If you already have an investment in Microsoft products, then InterDev is a natural choice.—*Todd E. Columb*

Microsoft Visual InterDev 1.0. List price: $499. Microsoft Corp., Redmond, Washington; 800-426-9400, 425-882-8080; www.microsoft.com. *Circle 449 on reader service card.*

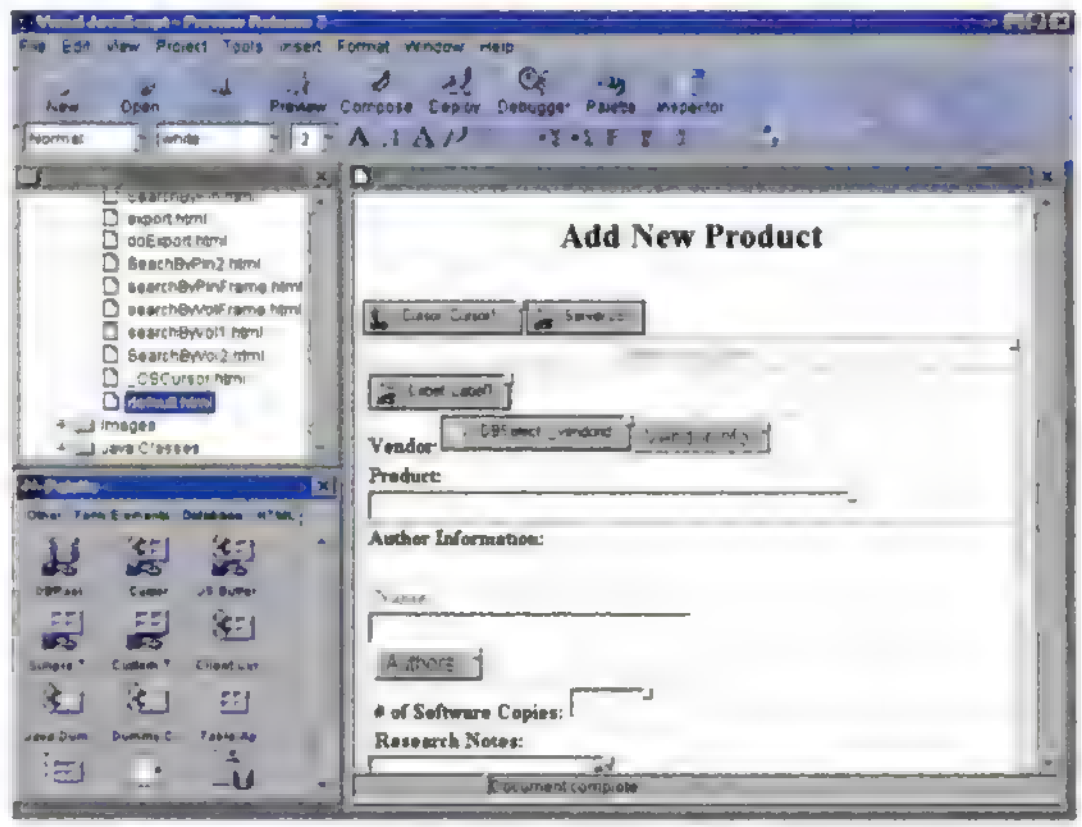
Netscape Communications Corp.

Netscape Visual JavaScript

Written entirely in Java and based on an open, component-centered architecture, Netscape Visual JavaScript 1.0 is a RAD tool for building database-aware Web applications. Visual JavaScript aims to be as easy to use as other visual tools, such as Delphi and Visual Basic, but its 1.0 incarnation lacks some basic functionality and has some rough edges. Netscape representatives constructed the test application, but couldn't get it to run reliably. (Note that though we reviewed a late beta version of the package, we saw enough of the finished product to include it in this roundup.) These deficiencies currently render Visual JavaScript unsuitable for heavy-duty enterprise development, though it may be passable for smaller projects.

Although Visual JavaScript is centered around the JavaScript language, Netscape says the tool is designed for the easy creation of extensible, cross-platform applications—something that is not yet possible with this product. In addition to JavaScript, the product provides strong support for languages and protocols such as HTML, Java, and CORBA and IIOP (Internet Inter-ORB Protocol).

Visual JavaScript certainly isn't fast, but because it comes bundled with a Java VM and a speed-enhancing JIT (just-in-time compiler), it provides passable performance for a standalone application. On a PC, the all-Java interface approaches the look and feel of a real Windows application, though it is still quite buggy: OK buttons were not automatically selected, so we had to click on them rather than merely hitting Enter to close a dialog, and refresh problems caused a number of screen anomalies.



All components within Visual JavaScript reside in a tabbed palette dialog box, from which developers can drag and drop components onto forms.

A great deal of Visual JavaScript's extensibility comes from its reliance on components, four types of which it supports: HTML components, such as check boxes and radio buttons; JavaScript components—which are written entirely in JavaScript and based loosely on Sun's JavaBean model—such as validated text boxes, scrolling tickers, and server-side database cursors; JavaBeans, which are reusable Java components that run in browsers supporting JDK 1.1 (and, depending on the Bean, browsers supporting JDK 1.0); and CORBA components, for running code on remote or legacy systems.

All components within the tool reside in a tabbed palette dialog, which lets users easily drag and drop components onto forms. Inspectors, or property editors, are also supplied for visually configuring components. Components can be dragged onto a form, customized by changing properties in the tool's Inspector, then dragged back onto the component palette. The new component will remember the settings for reuse within other forms or projects. Visual JavaScript's entire component palette can also be shared by placing it on a file server, which may work but doesn't compare favorably with more robust component mechanisms seen in tools like Oracle's Developer/2000.

Netscape pays close attention to event handling by creating a Connection Builder. Similar to the connection-building tools in Oracle's Developer/2000, this wizard lets you hook up components to events and notify other components (or have their properties changed) when an event is generated. To build a connection, you highlight a component on your form, drag it by a small tab, drop it onto another component (the act of dropping launches the Connection Builder dialog box), and finally select and set event choices.

Though this tool does not require Netscape Enterprise Server, Visual JavaScript certainly works better with Enterprise Server. For version control, Visual JavaScript must rely on Enterprise Server, and for load balancing applications, Enterprise Server is again the only tool that can do the job. Though the tool ships with a number of database components, these components only work with LiveWire. LiveWire, the database connectivity layer of Enterprise Server, supports DB2, Informix, ODBC, Oracle, and Sybase and has been in Enterprise since Version 2.0. In addition, when you get Enterprise Server, you get Oracle drivers and an Informix database.

Netscape includes no report-writing functionality with Visual JavaScript. Thus you cannot create banded reports or cross-tabs, as you can with Oracle's reporting tools, until Netscape or a third-party vendor creates the JavaScript components or JavaBeans to do the job.

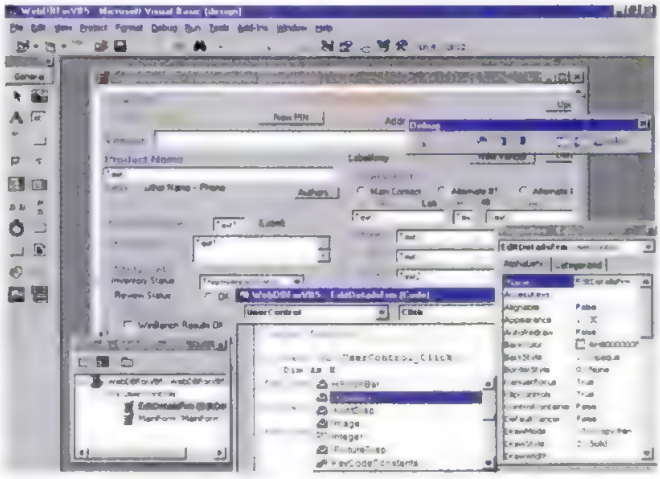
Visual JavaScript includes a JavaScript debugger for tracking down bugs in your

Web Development with Visual Basic 5.0

As traditional RAD tools step up to the Web, will they make the grade? Microsoft Visual Basic 5.0 Enterprise Edition offers a host of Internet features that succeed in taking your legacy applications into the brave new Web-based world while preserving the tool's popularity with developers. For best results, you'll probably need to do some application redesign; fortunately, VB5 offers a number of effective tools to get you started.

ACTIVEX TO THE WEB

You have two options when migrating VB5 applications to your intranet. The first and preferable method is to redesign applications using ActiveX components, which can be deployed on Microsoft Internet Information Server (IIS). Package your corporate database rules into ActiveX controls and they can be run behind the scenes.



Visual Basic 5.0 uses wizard-based programming with ActiveX to connect legacy VB code to the corporate intranet.

This trend began with Visual Basic 4.0, which had a redistributable architecture based on what was then called the Component Object Model (COM). Like PowerBuilder, with its remote objects, VB4 allowed corporate developers to think in terms of sophisticated, multitiered applications. Even before the arrival of the Internet, VB seems to have been ready: VB's strategy of running components remotely will facilitate moving those components onto your Web server.

VB5 lets developers build all types of ActiveX server components. A project wizard provides the framework here to get you started. Generally, programming ActiveX in VB5 is easier than in Visual C++, with the price of a slightly larger code size than in C++. With native code compilation in this new version, Visual Basic offers true optimized code for improved performance.

Once an application is designed using server-side components, the client can be as thin as you want. You can write VB applications that access ActiveX server components, which contain database access, whether through Remote Data Objects (RDO) or ODBC. For ultra-thin clients, you would use HTML-only and Active Server Pages (ASP) on the server. This would require using Microsoft Visual InterDev 1.0 (for more information, see the full review). The two packages, Visual InterDev and Visual Basic, are bundled in Microsoft Visual Studio 97 ($1,499 list).

For our testing, VB5 had a head start: We had built our model application using VB4 against an Access database. But just how hard would it be to transform this traditional client/server application into a Web-based application? The answer: Not hard at all.

MIGRATING TO THE WEB

The second way to get to the Web with VB5 is to migrate existing VB5 forms into ActiveX documents, which can be contained in an ActiveX browser. The VB5 ActiveX Document Migration Wizard proved a quick solution. Forms, menus, and other VB controls will be preserved as is. In a relatively complicated application such as ours, which had more than a dozen forms, navigating between forms—now Web pages—is a little trickier and involves moving between links.

The only disadvantage to this way of working is that this leaves you with a relatively fat client—the client does its own database access. For best results, you'll have to reengineer an application to put its database access into ActiveX components. If your code is already component-based, and especially if you've designed your application into a partitioned architecture, VB5 will make your Web efforts a lot less stressful. The good news is that the ActiveX document strategy requires minimal coding effort, and the Web version will have essentially the same look and feel as the client/server version. So you can say goodbye to interfaces dumbed down because of the Web.

THE VB BASICS

The standard tools for developing in VB5 haven't changed much, but a few new bells and whistles stand out, such as pop-up parameter wizard support within the programming environment, improved debugging, and drill-down watch windows for even the most complicated objects. For deploying your VB5 Web application on the client, a useful setup program generates Internet downloads for your ActiveX components (as well as traditional client/server setups).

If your organization has an installed Windows user base and a legacy code base in Visual Basic, there is little reason to look elsewhere for your Web database solutions.

—Richard V. Dragan

Microsoft Visual Basic 5.0 Enterprise Edition. List price: $1,199. Microsoft Corp., Redmond, WA; 800-621-7930; 425-882-8080; www.microsoft.com/vbasic. *Circle 449 on reader service card.*

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client-side JavaScript code (server-side debugging is currently not supported). This debugger, which itself is written in Java and runs as an applet, is a bare-bones debugger that lets you set breakpoints; step in, out, and over code; watch and modify variables; and perform debugging while JavaScript is being written (at runtime) into an HTML page.

Despite a rich array of supported features, Visual JavaScript 1.0 is still an immature product. But with an intelligent architecture that places a strong reliance on third-party components, it may have a bright future.—*Joshua Kerievsky*

Netscape Visual JavaScript 1.0 (beta). List price: $495. Netscape Communications Corp., Mountain View, CA; 650-937-2555; fax, 650-528-4124; www.netscape.com. *Circle 450 on reader service card.*

Oracle Corp.

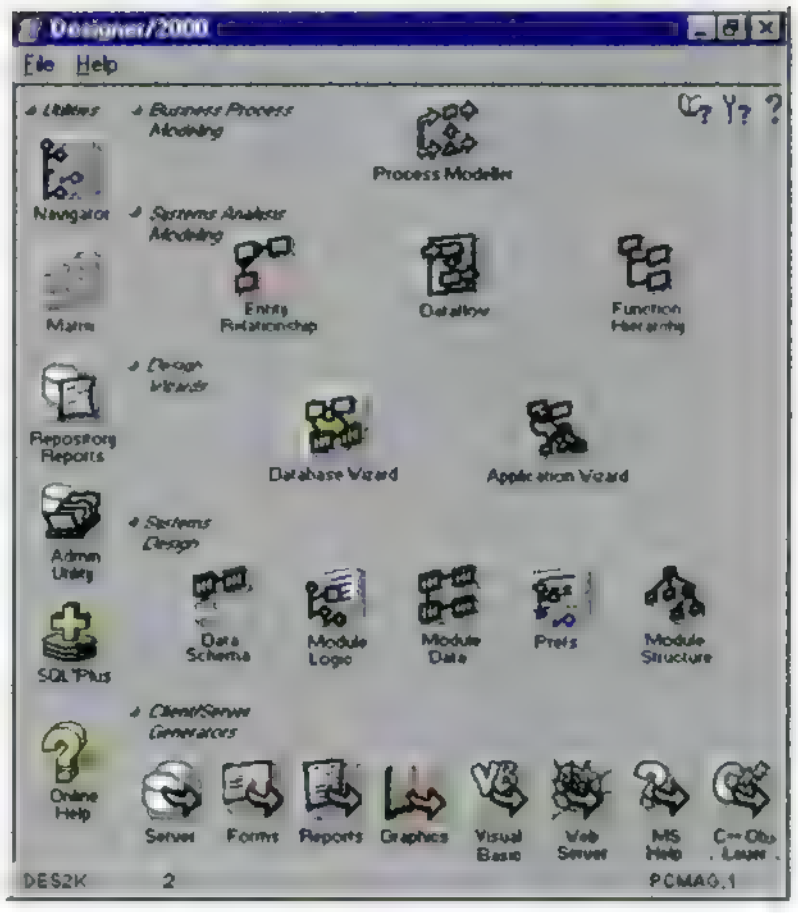
Oracle Web Developer Suite

PC MAGAZINE EDITORS' CHOICE

Oracle Web Developer Suite, targeted at enterprise and workgroup development, provides a comprehensive collection of powerful and mature tools for nearly every stage of the development life cycle. The suite's feature-rich RAD tools boost productivity and reduce the need to code, while the inclusion of a fully fea tured Web server—the Web Application Server—and the Oracle 7.3 database server make this a hard act to follow.

Based in part on Oracle's open Network Computing Architecture (NCA), this suite creates client applications that can run on anything from powerful Unix servers to Java-enabled browsers to low-cost network computers. Experienced developers will get the most out of the suite, which is object-based rather than object-oriented and is too heavy-duty for smaller projects. In addition, the suite's Java 1.1–only support precludes it from Web sites that require Java 1.02.

True to Oracle's multiplatform nature, Web Developer Suite is designed to solve problems in many languages on many platforms. Having started life in the traditional client/server world, these newly Web-enabled tools show many signs of maturity and sophistication. For example, you don't have to commit to a target platform during development. Instead, you can deploy a single application for multiple platforms—on the Web, for example, or, using standard client/server mode, in MacOS, and Microsoft Windows 3.*x*, NT, 95, and Motif.



The Designer/2000 tool lets you easily create or reverse-engineer database tables, views, and indexes for many RDB products

After creating a project, you can customize it using Oracle's *Procedural Language SQL* (PL/SQL) and then let the tools generate the project in the platform and language of your choice. You can select Java, which will let an application run within a Java applet on a Web page. Or you can select HTML, which will let an application run using pure HTML and JavaScript. You can also select traditional or network-based mode, which uses a standard client application. The tools even let you generate your project in Microsoft Visual Basic.

Interface development is centered around Oracle's PL/SQL, an enhanced version of SQL that lets you write procedures, functions, global variables, packages, triggers, and so forth. In case your stored procedure does something odd, Web Developer Suite comes with a debugging tool that a number of notable database vendors, such as Sybase, still don't provide. PL/SQL can customize the behavior of generated forms. For instance, you can embed PL/SQL instructions into a button, and those instructions will then be rendered into whatever language the project is deployed in.

Web Developer Suite is not difficult to install, but the process is lengthy. The product comes with a collection of tools (Designer/2000, Developer/2000), servers (Developer/2000 Reports Server, Oracle 7.3 server, Oracle Web Application Server), InterOffice, the NCA Cartridge Developer's SDK, and one year of access to the Oracle Developer Program. The Suite's servers run under AIX, HP-UX, Microsoft Windows NT, and Solaris, and they support transaction-processing monitors such as Encina, TopEnd, and Tuxedo.

Designer/2000 and Developer/2000 provide the one-two punch for creating three-tiered enterprise systems. Designer/2000 is a multiuser tool that creates repositories for an application's business rules. It does the heavy-duty code generation mentioned above and communicates with Developer/2000. Designer/2000 lets you create or reverse-engineer database tables, views, constraints, and indexes for RDB products such as DB/2, Oracle 7.3, Oracle Rdb, SQL Server, and ODBC-compliant databases.

Creating application forms is simply a matter of dragging and dropping fields, making connections between forms, and optionally choosing and configuring applicationwide form styles. Designer/2000 lets you create and manage complex data models, supports business-process reengineering (BPR), and handles code generation for the many supported platforms. The Developer/2000 tool lets you edit and debug Designer-created or hand-coded applications, and it contains a robust Object Navigator that gives developers easy access to just about every tier within a project.

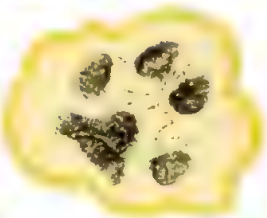
From the Object Navigator, you can edit triggers, lists of values (LOVs), attached libraries, pop-up menus, reports, forms, and a host of other attributes including server-side procedures and functions. Developer/2000 offers you the option of outfitting your applications with interactive components such as OCX/ActiveX controls. (Support for Java Beans is said to be coming soon.)

Developer/2000's report generation is flexible and easy to use: You can have reports created in HTML or, for a more professional look, in Adobe Portable

Other Web Database Development Solutions

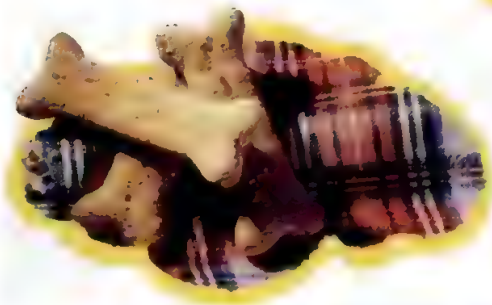
You don't have to buy a tool from a major database vendor in order to create a database-enabled Web application. Here's a quick take on some other products that offer RAD functionality and database connectivity.

Product	Company	Price	Phone	URL	Description
ActiveWeb 2.0	Active Software, Santa Clara, CA	Starter package (5 developers), $75,000	408 988-0414	*www activesw com*	The ActiveWeb suite of tools provides a complete Web-based solution, including agents and connectivity to a wide variety of databases
Apptivity Developer & Server 1.0	Progress Software Corp., Bedford, MA	$1,995 per developer; server licenses start at $5 000 for 20 users	888-277-3279	*www apptivity com*	This proprietary Java-based database package offers full SQL connectivity and a server that runs on all major platforms
ASG-KnowledgeWave 1.0	Allen Systems Group, Naples, FL	Starts at $7 500, varies according to server type and platform	800-475-7171	*www allensysgroup com/home htm*	This development solution—geared toward modeling help desk systems, product catalogs, and customer-support Web sites—can be developed by nonprogrammers
Clarion Internet Edition 1.0	TopSpeed Corp., Pompano Beach, FL	Internet Developer's Kit, $499, application broker, $999	800 354 5444	*www topspeed com*	The Internet Edition of Clarion's database product allows Web access through its Application Broker server extension
Cold Fusion Professional 3.0	Allaire, Cambridge, MA	$995	888-939-2545	*www allaire com*	Cold Fusion provides rapid prototyping, dynamic Java forms, and support for ActiveX, JavaScript, and Cold Fusion's proprietary search technology
4th Dimension 6.0	ACI US Inc., Cupertino, CA	5 users, $299	800 881-3466	*www acius com*	A database known for its ease of use, 4th Dimension incorporates on-the-fly translation of database forms into HTML
Fresco 2.0	Infoscape Inc., San Francisco, CA	Pilot package (2 developers, 1 server, 50 users), $4 950	415-442-5050	*www infoscape com*	This Java-based intranet solution stresses performance, transaction management, and rapid applications development
HahtSite 3.0	HAHT Software Inc., Raleigh, NC	Developer, $1,995 application server, $4,995 per CPU	888-438 4248	*www haht com*	Version 3 0 of the HahtSite package features full Java support, a distributed server, and additional RAD tools
iXpress 2.5	Software AG Americas, Reston, VA	Starts at $5,000 per server	800-843-9534	*www sagus com*	The iXpress package features dynamic content using DYNAtag HTML extensions that can access server-side databases through ActiveX, Java, and ODBC
JDesignerPro 2.2	BulletProof Corp., Los Gatos, CA	$995	800 505 0105	*www bulletproof com*	JDesignerPro offers JavaBean–enabled RAD and a server that deploys Java-based intranet applications
JetAssist 1.0, JetConnect 2.0	XDB Systems, Columbia, MD	Unlimited users, $6,500	800-488-4948	*www xdb com*	You can connect to databases through JDBC and Java without writing code using XDB Systems' tools
Netiva 1.0	Netiva Software, Campbell, CA	Variable 5 users, $299 100 users, $4,999	888 263 8482	*www netiva com*	Netiva's DataPage technology stresses ease of use in creating dynamic content, which can include non-SQL database links sent to the client using Java
Omnis Studio 3	Omnis Software Inc., [illegible], CA	[illegible]	800 346 6641	[illegible]	Version [illegible] brings Web capabilities to Omnis Studio, a 4GL development tool that lets developers mix and match such components as ActiveX and Java
Prolifics 3.0	Prolifics (a Jyacc company), New York, NY	$35,000, workgroup, $2,400	800 458-3313	*www prolifics com*	From the makers of Jam/Web comes Prolifics, a development solution that offers embedded middleware, a server-side development tool, dual Java/HTML deployment, and subscribe and publish push technology
Sapphire/Web 4.0	Bluestone Software, Mount Laurel, NJ	$4,995 per developer	609 727 4600	*www bluestone com*	Bluestone s Web database package now uses Java to build scalable Web-based databases and allows developers to choose from a wide variety of deployment options
SilverStream 1.0	SilverStream Software, Burlington, MA	$495 per developer, application server licenses start at $4,995	888 823-9700	*www silverstream com*	SilverStream, which uses Java on both client and server, features such highlights as JDBC access, integrated e-mail, and agents to deliver push content
Tango Enterprise 2.11	EveryWare Development, Mississauga, Ontario, Canada	5 users $995, unlimited users $2,295	888 819 2500	*www everyware com*	Tango Create allows you to create dynamic content without programming and to access any ODBC databases on the server with Tango Enterprise
Vibe Enterprise 1.0	Visix Software Inc., Reston, VA	$3,995	888 876 8423	*www visix com*	Vibe Enterprise adds RAD database capabilities for Java-based Web interfaces
VirtuFlex 2.0	VirtuFlex Software, Cambridge, MA	$1,400 per developer	617 497 8006	*www virtuflex com*	In addition to Java and database connectivity, VirtuFlex offers e-mail, threaded discussion groups, Internet faxing, and examples of common Web applications
Vision/Web 3.0	Unify Corp., San Jose, CA	5 developers, $7,200, runtime deployment licenses start at $25,000	800 455-2405	*www unify com*	Vision/Web, which generates Java applets based on CORBA using a 4GL environment, includes database and transaction management support
VisualWave 2.0, VisualWave Server 2.1	ParcPlace-Digitalk Inc., Sunnyvale, CA	VisualWave, $495, VisualWave Server $4,995	800 759 7272	*www parcplace com*	VisualWave lets you develop Web applications using SmallTalk, a true object-oriented programming language, and then deploy them using VisualWave Server



Christian Murphy was non-verbal. He lived with a wall between himself and the world.

1 THIS IS CHRISTIAN.
He can see, hear, feel, touch, but he cannot speak. He was born with autistic tendencies that cut him off from the world around him.



2 A TEACHER DISCOVERED *that Christian would respond to images from his life. She put visual cues to the story of his new puppy on a special keyboard.*

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3 THE MONITOR BECAME HIS VOICE. *With it he makes class reports and conversation. With it, Christian, 11, has been in the regular Osterville, MA public school since first grade.*

Until he found this window.

4 WITH THE PICTURES, HE MADE SENTENCES. *With the sentences, he made friends. Christian's monitor is the window between his non-verbal world and the speaking world of his friends. Through it, he teaches them many things.*

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E500	1280 x 1024 @ 65Hz	119MHz	CROMACLEAR	0.25mm mask
E700	1600 x 1200 @ 65Hz	177MHz	CROMACLEAR	0.25mm mask
E1100	1600 x 1200 @ 65Hz	177MHz	Dot Trio	0.28mm dot

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TESTING REPORT

Web Development

The applications resulting from our testing of Web database development tools show that this is an unsettled but fast-growing category. Each vendor's developers created a Web-based application, then made requested adjustments on the fly.

How We Tested

For this Web database tool roundup, we started with a real-world legacy inventory database application from PC Magazine Labs, written in Visual Basic 4.0. This "Product List Editor" application has been used since 1993 to track the arrival of products for hardware reviews here at One Park Avenue in New York City. The Visual Basic application was designed to replace and upgrade an Rbase system used previously. It lets our research and editorial staff see what products have arrived, along with contact and other status information. More than 20 fields can be displayed. Views can be customized in a spreadsheetlike interface.

All in all, the Product List Editor is a very traditional "fat client" application, complete with legacy problems. For each of the six vendors in the main section of the roundup, we delivered a working .EXE (without source code), a sample Access database (with 14 tables), and a short specification and requirements document (including sample screenshots) a month before the vendor came to PC Labs. Vendors were invited to use their own in-house programming expertise to show off what their Web database solutions could offer in terms of user functionality. (In theory, the solutions they came up with are best-case versions of what each tool can do.) We didn't restrict what the interface could look like, as long as the basic functionality we were after was included.

We also advised each vendor that performance wouldn't be a factor, unless an application was hopelessly sluggish. We were interested in their creating feature-rich, Web-based solutions for corporate users that wouldn't leave them out in the cold, missing the functionality they'd already been accustomed to for years. (We hoped this would mirror the situation of today's corporate developers, who can't afford to deliver hobbled Web-based versions of existing applications.)

Our in-house testing script consisted of modifications and additions to the original application. The original app was mostly for lookups, so we added maintenance screens for many of the tables. We also gave end users the ability to customize their views of the product list editor. Two areas that sometimes required creative solutions were the data input screen (from a comma-delimited file) and the report screen.

Vendors were asked to send representatives to work with our reviewers for three days. The first day usually centered on installing both the product and the application the vendors had prepared. The remaining time was used to work through the modification script. This ensured that we could see how much programming was needed to write and maintain the application, how easy it was to deploy, and the like. Though most of the work was done ahead of time by each vendor, significant new functionality was added while we looked over the vendors' shoulders here at PC Labs. The reviewers and vendors were given a basic intranet configuration that consisted of four machines: two Microsoft Windows NT 4.0 servers (Service Pack 3), one Microsoft Windows NT 4.0 client (Service Pack 3), and a Windows 95 OSR2 client. All machines were identical Micron Pentium/166s, with 64MB of RAM on the servers and 32MB of RAM on the clients. We preconfigured the servers with Microsoft IIS 3.0 (which came with SP3) and ran the entire setup over an Ethernet 10Base-T network. On the clients we installed Microsoft IE 3.12 and 4.0 beta, and Netscape Communicator. The vendors were then free to install additional Web servers and databases.—*Analysis by Rich Dragan and Jay Munro*

Document Format (PDF). You can have reports generated dynamically and made interactive, with drill-down capabilities, embedded links to other Web pages, clickable/hyperlinked charts, and dynamically generated tables of contents. Using the Developer/2000 Reports Server, you can schedule reports to run and refresh themselves periodically.

If you choose to have your project run within a Java applet on a Web page, you will need a browser that supports the Java Developers Kit (JDK), Version 1.1. As of this writing, the only mainstream browsers that support JDK 1.1 are the prereleases of Netscape Communicator and Microsoft Internet Explorer 4.0 (which Oracle used in our tests). JDK 1.1 makes creating more sophisticated forms easier, and Oracle's Web Developer Suite takes advantage of the 1.1 enhancements.

When we compared the Java-applet version with the standard Windows client/server version of the sample application, the two were nearly identical. The Java version demonstrated a few refresh problems and ran slightly slower than the client/server version, but it did not require any client-side software installation. JavaSoft has certified the Java runtime as 100% Pure Java.

Oracle Web Developer Suite offers an almost endless array of features for creating demanding enterprise projects. Developers will especially appreciate the Suite's forward-thinking architecture, which undoubtedly guarantees Oracle a top spot in the future of Web database development.—*Joshua Kerievsky*

Oracle Web Developer Suite 1.1. List price: $7,995; for VARs and ISVs, $1,995. Oracle Corp., Redwood Shores, CA; 415-506-7000; fax, 415-506-7200; www.oracle.com. *Circle 451 on reader service card.*

Sybase Inc.

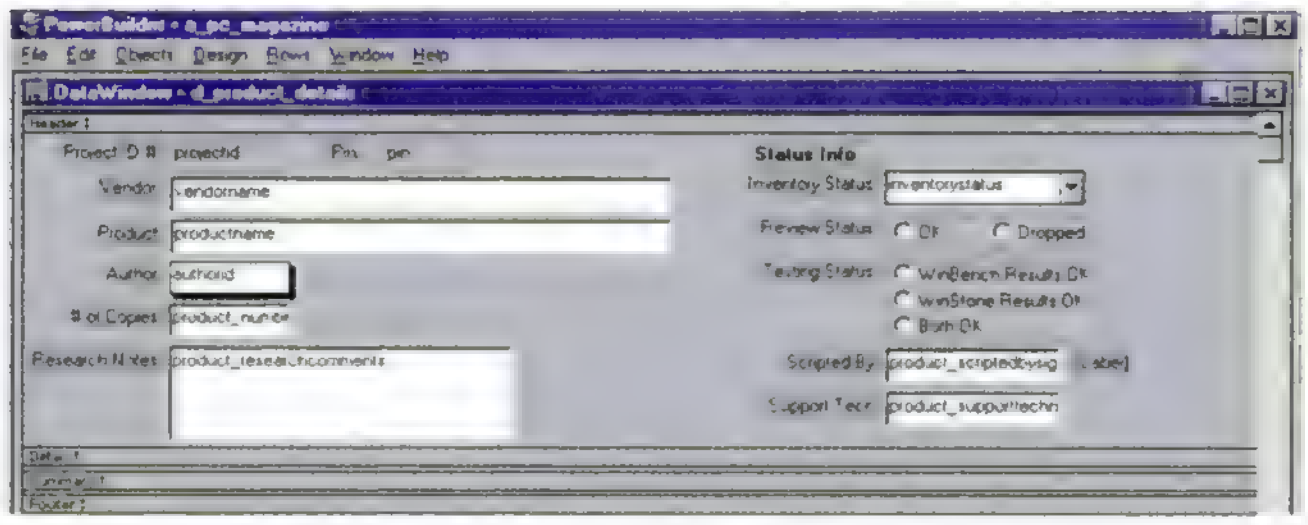
PowerBuilder Enterprise

Sybase, long a top player in the world of client/server applications, has reengineered its traditional client/server tools for Web development, with little success. PowerBuilder Enterprise 5.0 is an unwieldy solution that relies too much on the traditional client/server model rather than something better suited for the Web. Unless your company is already a PowerBuilder shop and you need to deploy legacy applications quickly, without regard to client size, you should consider the superior solutions offered by several of the other vendors in this roundup.

PowerBuilder uses two development methods: One is a fat-client approach in which you Web-enable preexisting PowerBuilder applications; the other, called Web.PB, is a thin-client, pure Web-appli-

cations approach. Each has its drawbacks.

With the client/server method, you get more functionality than you would from Web.PB, but you lose the thin client and have to hand-code some HTML—though typically only about five lines—yourself. With Web.PB, however, you lose PowerBuilder's UI tools.



With PowerBuilder, Web-enabling apps is only a bit more difficult than creating traditional client/server apps. You can rapidly port PowerBuilder apps to the Internet with the Window and DataWindow plug-ins.

You can rapidly port existing PowerBuilder client/server applications directly to the Internet with PowerBuilder's Window and DataWindow plug-ins. Web-enabling an application is only marginally more challenging than creating a traditional client/server application, and you can take full advantage of PowerBuilder's outstanding RAD tools.

Unfortunately, you may end up paying on the client side: Each client must have the runtime files and plug-ins DLLs installed in order to run the application. This may not be an issue for intranet use, but it certainly rules out using this approach if you ever plan to expand to an extranet or to the Web. Though the application would still run in any browser, the more than 8MB of space required by the runtime files and plug-in DLLs would seriously slow the first execution of an application running over a dial-up connection.

This plug-in approach works by placing PowerBuilder code—compiled into a PowerBuilder Dynamic Library (PBD) file—onto the Web server, from which the browser can receive and access each of the objects contained therein. The end result is the full power of your application running as a child window in the browser, using the Window plug-in. To implement this, you need to register the MIME types for your PowerBuilder application manually on the Web server.

The PBD files are accessed through an HTML <embed> tag, specifying the PBD to run, the size of the child window, and the window object within the PBD to be executed. The DataWindow plug-in lets the client display Powersoft Report (PSR) files directly in the browser.

Luckily, PowerBuilder does not limit you to a fat-client application. With a separate Internet Developer Toolkit extension, you can create a thin-client Web application using nonvisual objects that generate HTML on the fly. Web.PB can produce a powerful and elegant application that requires only a simple client browser. Experienced PowerBuilder users will be able to create an intranet database application rapidly, even without a strong background in HTML. Unfortunately, if you use Web.PB to implement a Web application, you will lose many of the UI tools native to PowerBuilder, thus restricting the client interface to HTML elements.

Web.PB offers two approaches to generating an application: You can dynamically generate HTML based on the output from a function, or you can interactively use PowerBuilder functions to create an HTML page on the fly. The first way, perhaps the easiest to implement, uses a function to create a DataStore, retrieve information, and generate an HTML string based on the results of the retrieval.

If necessary, you can pass parameters to a function, which can contain SQL queries, to make the retrieval more specific. An included Web.PB wizard will generate the HTML code to call your function. If you are passing arguments to your function, the wizard will assist you in generating an HTML form to prompt the user for input, passing that data to your function to retrieve data properly.

The second approach is to generate HTML from within a PowerBuilder script—a clumsy process that proves more difficult than simply writing the HTML in a text editor. You create static HTML elements by calling Web.PB functions that store formatted HTML as string values in your script. You can then extend this HTML generation through the powerful functions in the Web.PB class library, which provides a host of rich functions to help create an interactive HTML session.

Any elements contained within an HTML page, such as buttons, text fields, or labels, can be created dynamically by instantiating a Web.PB object. Taking advantage of this library allows you to create more diverse elements on your HTML page, such as building forms, each of whose elements are bound to a field in your DataStore. Calling one of the functions in the library returns the resulting HTML tag as a string that the calling function can then use. Creating the final page is as easy as combining the strings into a single value and returning that value as raw HTML to the browser.

Sybase has made great strides in expanding PowerBuilder to the Internet, and the next release promises to continue in that direction. For now, each of the deployment methods you have to choose from extracts a unique price, and none may be able to provide the power and extensibility you require.—*Heath H. Herel*

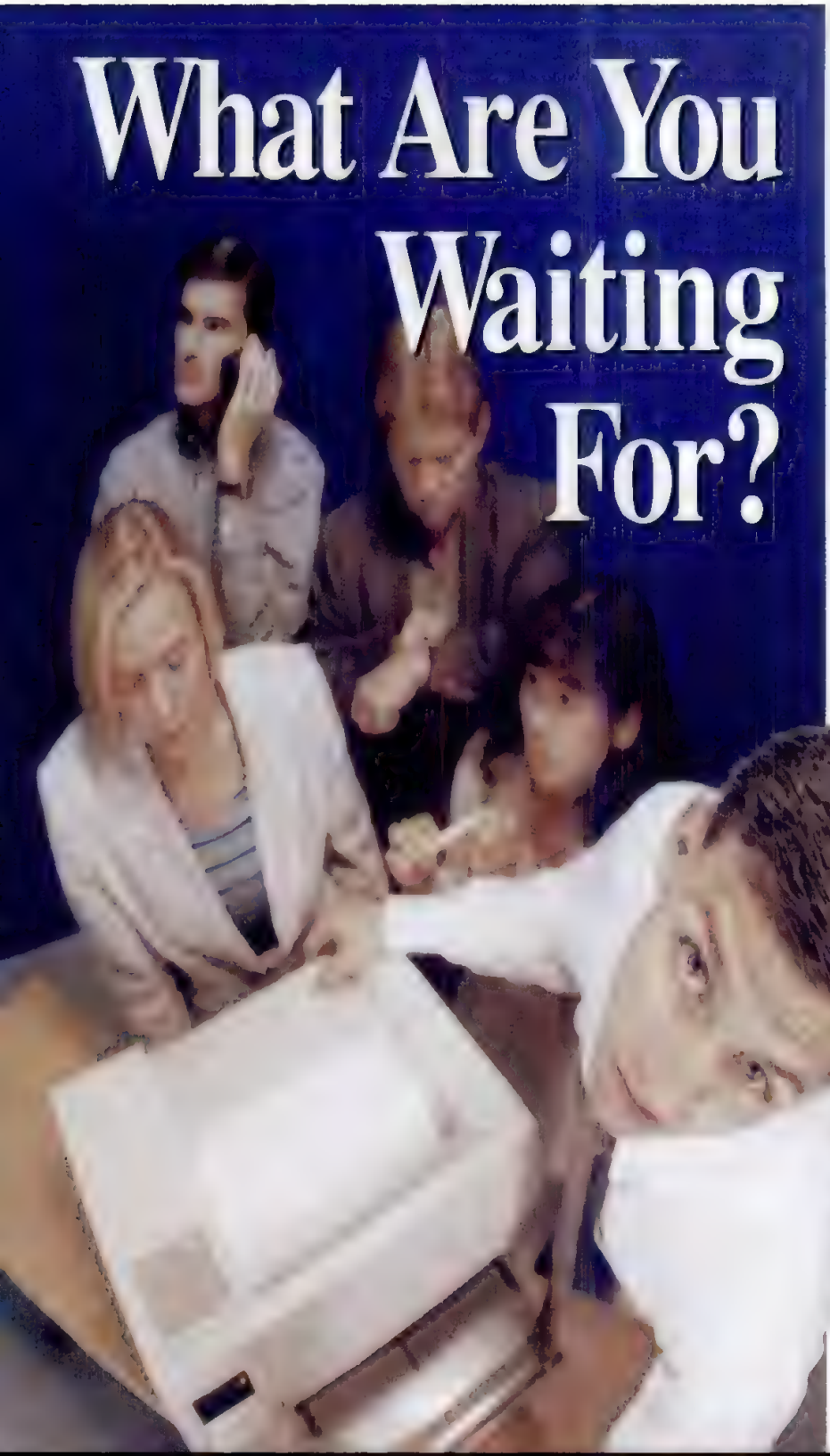
PowerBuilder Enterprise 5.0. List price: PowerBuilder, $2,995; Internet Developer Toolkit for PowerBuilder 5.0, $99. Sybase Inc., Concord, MA; 800-395-3525, 508-287-1500; www.sybase.com. *Circle 452 on reader service card.*

Apple Computer Inc.

WebObjects Enterprise

Through a strong object-oriented development environment, WebObjects Enterprise 3.1 lets you quickly create powerful server-side applications that run on an ultrathin client. WebObjects 2.0 shone in our roundup last year of first-generation Web database development tools because of its power, but we found you had a lot of coding to do.

This new version does provide some excellent RAD tools to assist in the quick creation of intranet applications, but to harness the full power of WebObjects, be



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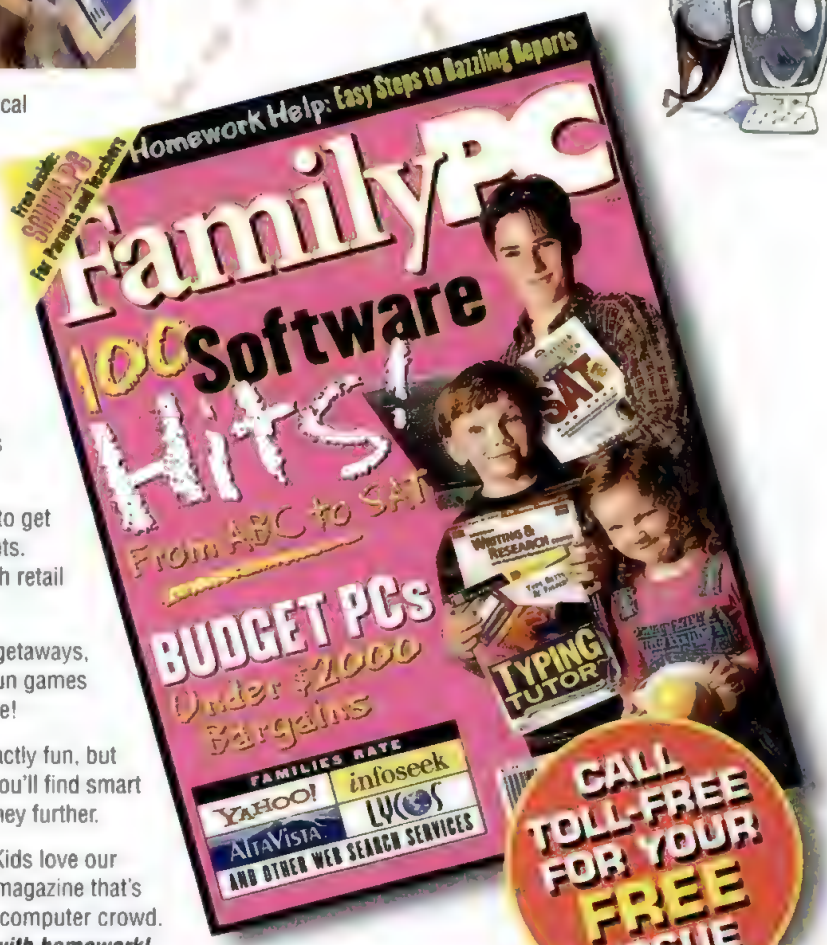

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Web Database Development Tools

PC MAGAZINE EDITORS' CHOICE

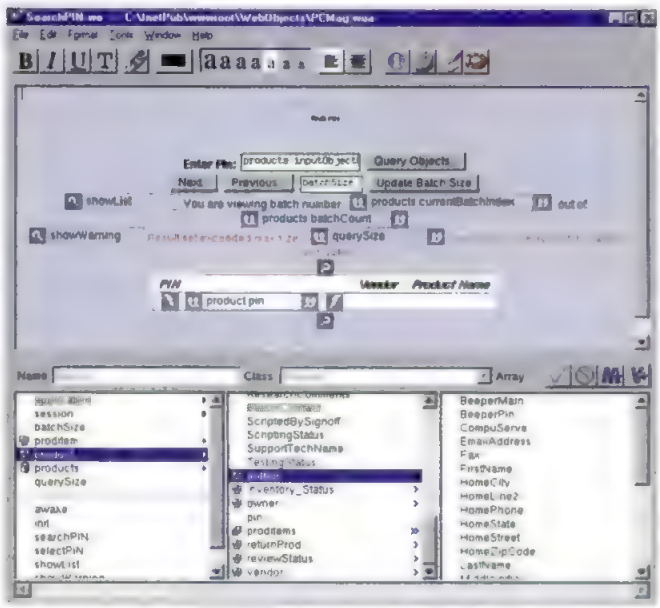
■ YES ▨ NO □ OPTIONAL
Products listed in alphabetical order

	Borland IntraBuilder Client/Server 1.5	Microsoft Visual InterDev 1.0	Netscape Visual JavaScript 1.0	Oracle Web Developer Suite 1.1	PowerBuilder Enterprise 5.0	WebObjects Enterprise 3.1
List price	$1,995	$495	$495	$7,995 ($1,895 for VARs and ISVs)	$2,995	$1,495
Client-Side Deployment Options						
HTML only/Java only/HTML and scripting	■ ▨ ■	■ ▨ ■	▨ ▨ ■	■ ■ ■	▨ ▨ ▨	■ ■ ■
JDK 1.0/JDK 1.1	▨ ▨	▨ ▨	■ ■	▨ ■	▨ ▨	■ ▨
Requires ActiveX/Netscape plug-in	▨ ▨	▨ ▨	▨ ▨	▨ ▨	▨ ▨	▨ ▨
Supports JavaScript/VBScript	■ ▨	■ ■	■ ▨	■ ■	■ ■	■ ■
Supports Netscape Navigator 2.0 / 3.0 / Communicator 4.0	■ ■ ■	■ ■ ■	■ ■ ■	▨ ▨ ■	■ ■ ▨	■ ■ ■
Supports Internet Explorer 3.0 / 4.0	■ ■	■ ■	■ ■	▨ ■	■ ▨	■ ■
Supports client-side report printing/Allows client-side file access	■ ▨	■ ■[1]	▨ ■	■ ▨	■ ■	■ ▨
Operates without requiring local proprietary libraries	■	■	■	■	▨	■
Server Support						
Operating system:						
Windows NT/Unix/Macintosh	■ ▨ ▨	■ ▨ ▨	■ ■ ■	■ ■ ▨	■ ■ ■	■ ■ ▨
Web servers:						
Apache/Microsoft Internet/Netscape FastTrack Server	▨ ■ ■	▨ ■ ▨	■ ■ ■	■ ■ ■	■ ■ ■	▨ ■ ■
Uses CGI	■	■	▨	▨	■	■
Native database server support:						
Oracle (version)	■ (6.x, 7.x)	■ (8)	■ (7.3)	■ (7, 8)	■ (7.3)	■ (8)
Sybase (version)	■ (4.x, 10.x, 11.x)	■ (11)	■ (11)	■ (11)	▨	■ (11)
Microsoft SQL Server (version)	■ (4.x–6.x)	■ (6.5)	▨	■ (6.5)	■ (6.5)	■ (6.5)
Microsoft Access (version)	■ (95)	■ (97)	▨	■ (97)	▨	■ (97)
Supports ODBC	■	■	■	■	■	■
Session Management						
Application preserves intrasession (page-by-page) state info	■	■	▨[2]	■	■	■
Application preserves intersession state info (between log-ons)	■	■	▨[2]	▨	■	■
Supports HTTP KeepAlive	■	■	▨[2]	■	▨	▨
User load managed by Web server/dedicated middleware	▨ ■	■ □[3]	■ ■	■ ■	▨ ▨	■ ■
Enforced page sequence/Timed session expiration	■ ■	■ ■	■ ■	■ ■	▨ ▨	■ ■
Map Web authentication to database authentication	■	■	■	■	▨	■
User-based authentication	■	■	■	□	▨	▨
Applications Development						
Includes development Web server/database server	■ ■	■ ▨	▨ ▨	■ ■	■ ■	■[4] ▨
Wizards for common development tasks	■	■	■	▨	■	■
Integrated HTML editor/Bundled with HTML editor	▨ ■	■ ■	■ ■	▨ ▨	▨ ▨	■ ▨
GUI screen painter/HTML generation via screen painter	■ ■	▨ ▨	■ ■	■ ■	■ ▨	■ ■
Graphical query builder	■	■	■	■	■	■
Heterogeneous join/updates	■ ■	■ ■	▨ ▨	■ ■	▨ ▨	■
Creates scheduled queries and push channels	▨	■	▨	■	▨	■
On-the-fly application syntax checking	■	▨	▨	▨	■	■
Integrated version control/Third-party hooks	▨ ▨	■ ■	▨ ■	▨ ■	■ ■	▨ ■
Developer security levels	▨	■	▨	■	▨	▨
Wizard-based applications deployment	▨	■	■	▨	▨	▨
Complex reports via HTML/via plug-in or helper	■ ▨	■ ■	▨ ▨	■ ▨	▨ ■	▨ ▨
Debugging						
Tests in development environment	■	■	■	■	■	▨
Interactive debugger	▨	▨	▨	■	■	■
Breakpoints/Watch points/Watch variables	▨ ▨ ▨	▨ ▨ ▨	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Step/Trace/Remote debugging via the Internet	▨ ▨ ▨	▨ ■ ▨	■ ■ ▨	■ ■ ▨	■ ■ ▨	■ ▨ ■
Help and Technical Support						
Context-sensitive help	■	■	■	■	■	■
Manuals online/Web-based help	▨ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Language/SQL syntax help	■ ■	■ ■	■ ▨	■ ■	■ ▨	■ ▨
Free ongoing technical support	▨	▨	▨	▨	■	▨
Fee-based technical support	■	■	■	■	■	■
Toll-free number/900 number for technical support	■ ▨	■ ■	■ ▨	■ ▨	■ ▨	■ ▨
Web/BBS/e-mail support	■ ▨ ■	■ ■ ▨	■ ▨ ■	■ ▨ ■	■ ■ ■	■ ▨ ■

(1) Only via browsers that support standard file downloads—Navigator and Internet Explorer 3 and 4. (2) Server functionality is available through Netscape Web servers. (3) Optional use of MS Transaction Server. (4) Unix version only.

prepared for a great deal of hand coding. This makes WebObjects less approachable than Microsoft's or Oracle's products, which offer better ease of use through RAD development without any loss of extensibility.

WebObjects is not a client/server tool jerry-built for Web development; therefore it provides a solid development experience. Although past versions of WebObjects relied heavily on writing code in Objective-C, you can now take advantage of client-side Java as well as writing code in Apple's WebScript language, a subset of Objective-C. We found that implementing all three of these technologies within our test application provided the strongest solution. Because you can create reusable components—either visual objects or compiled server-side code—WebObjects lets you reap the same benefits as if you were generating a traditional client/server application.



The latest version of WebObjects provides excellent tools for creating intranet apps, but to harness its full power, be prepared for considerable hand coding.

The Enterprise Objects Framework utility, included with WebObjects, handles database connectivity superbly. To create the connections between enterprise objects—part of your WebObjects application—and your databases, you need to build a model that defines that mapping.

The enterprise object modeler (EOModeler) provides a graphical method of administering data within your application without ever having to touch the actual data source. Reading the data dictionary into the EOModeler is intuitive, and EOModeler will bring all tables, relationships, and stored procedures directly into the model. You can then customize the model to suit the needs of your application, applying rules beyond the ones already defined at the data source.

For those who need to design and generate primary keys or SQL code, EOModeler can perform these functions directly. Adding the code generated by the model into your project provides all the functionality contained within the model, and it provides the middle layer to bind your application back to the data source. Native support is provided for Informix, Oracle, and Sybase data sources, and you can easily connect to any other source using ODBC.

Creating HTML screens is done largely through the WebObjects Builder. This GUI tool works in tandem with the EOModeler to generate static HTML pages quickly that hook into your data source and can be accessed easily across an intranet. Linking a form to your model is as easy as drag-and-drop, and the full power of your model is immediately available within the page you are designing. Creating the actual page feels much like generating forms with any GUI tool; you merely drag and drop the control you want directly onto the page.

The reusable component palette provides a variety of elements that you can insert in a page, from static elements such as tables and headings to HTML form elements. For even more power, you can add abstract elements, which let you create repetitions of objects, conditional statements, and custom elements such as reusable templates. Additionally, you can insert external components in your page, such as Java applets and ActiveX controls.

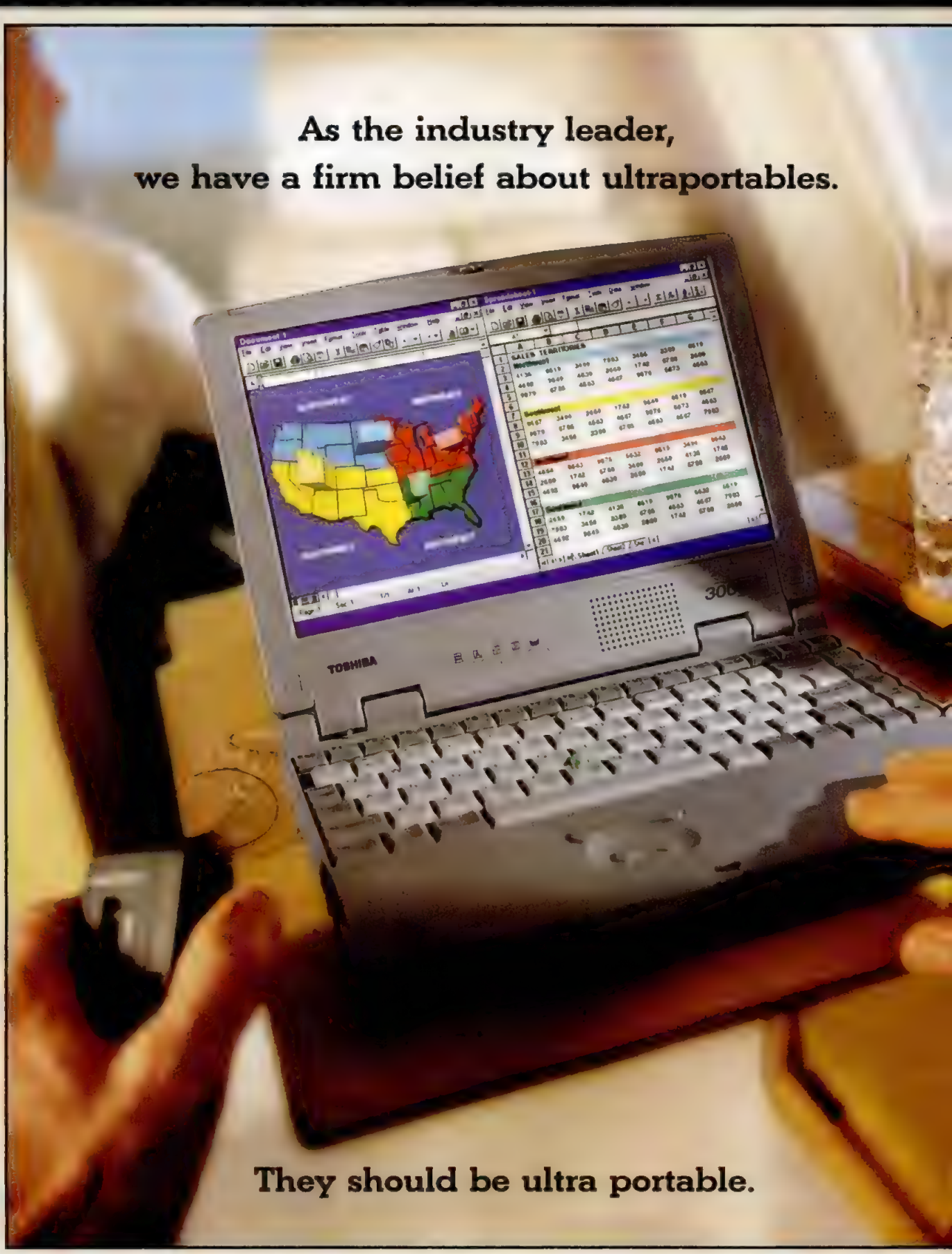
Once the interface has been defined, you'll find it relatively simple to add code behind the scenes to obtain the raw power your application requires. A built-in object browser aids in navigating through your application's components, and an inspector provides at-a-glance information about each element on your page. The HTML for each page is generated by the WebObjects Builder, which updates tags in the background while you work in a WYSIWYG environment.

The WebObjects Builder also comes with a simple wizard that lets you quickly create some basic HTML pages connected to your data model. The wizard provides some basic templates that you can use to create search screens, output tables, and basic data-entry forms. After you select a model at the beginning, the wizard generates your page and a small amount of code, with the controls already bound to the correct fields in your model.

To tie the entire application together, you use the Project Builder, which also integrates code editing, compiling, and debugging features. WebObjects offers impressive debugging capability, a critical tool that is missing in both Visual InterDev and IntraBuilder. WebObjects tracks state through the use of a Session object that is created each time a client logs on to the application. Global information is stored in an Application object, and each component in your application has an object associated with it to handle state.

We were able to extend the power of our application with some external tools. We generated a monitoring application with WebObjects that allowed us to monitor all instances of our application remotely. We tracked instances where the application died and could configure the application to roll over to another instance that was running. Alternately, this same utility allows for any instance of your application to restart immediately after death. Third-party vendors are currently writing a number of Macintosh tools for WebObjects.—*HHH*

WebObjects Enterprise 3.1. List price: $1,499. Apple Computer Inc., Cupertino, CA; 800-879-6398, 408-996-1010, www.apple.com. *Circle 453 on reader service card.*



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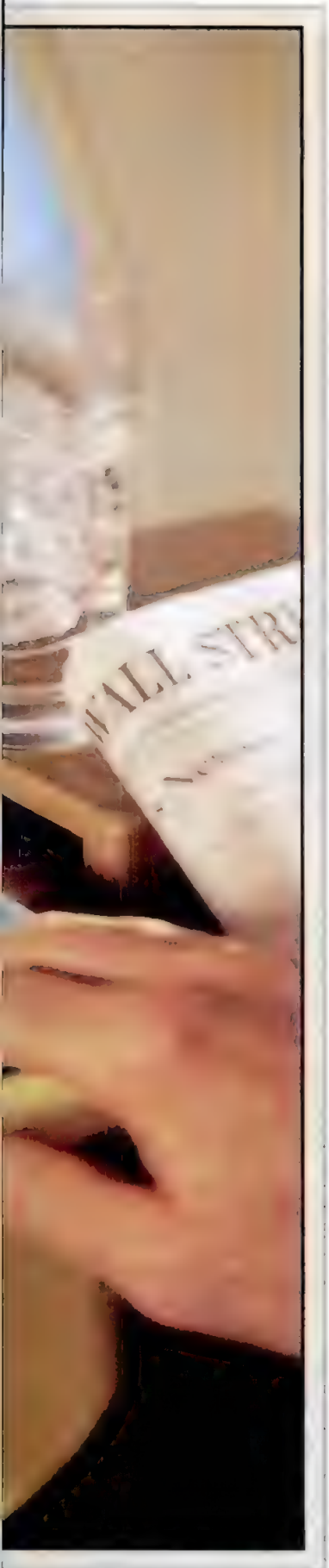

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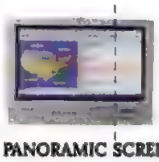

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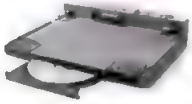

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Net Tools

Safety from the Net

Windows NT firewalls have taken the firewall market by storm. But how effective are they compared with their Unix cousins?

By Robert P. Lipschutz

Like Fort Knox, your LAN contains your corporate treasure. And, like a fort, your LAN needs physical and administrative features in a layered defense. These security layers include firewalls, Web-caching proxy servers, and URL filters. Like gate guards, firewalls provide fine-grained protection by checking the authorization of each person and packet entering or leaving a secured area. Web-caching proxy servers are like commissary trucks that bring in goods—in this case, Web pages—from the outside for redistribution. Internal redistribution reduces the traffic through the gate. Proxy servers can also be used to block all other incoming traffic. URL filters are simply censors that let you control network-user access to specific Internet sites. Some newer products, such as Novell's Border Services, bundle several of these security services.

Firewalls are typically found where a company's internal network meets the Internet. As a rule, the more services you allow internal users to access on the Internet, the more risk you have of a hacker exploiting the holes that access cre-

ILLUSTRATION BY DENNIS HARMS

INSIDE

WINDOWS NT FIREWALLS: It wasn't long ago that protecting your internal network meant purchasing a Unix-based firewall. The last year

has seen the introduction of several Windows NT–based firewall products. But how secure are these products, and what will they do to your network performance? In this Net Tools feature story, PC Labs and contributors Jeffrey Witt and Robert P. Lipschutz test five top Windows NT–based firewalls, evaluating them for security, ease of use, performance, and their ability to take on new challenges such as CORBA and DCOM. *Page 243.*

SUN SOLARIS 2.6 Sun and other Unix vendors have been watching Microsoft Windows NT Server barge its way into the networked applications space that was once dominated by Unix. It's taken some time, but Sun is now making an effort at a major counterattack, giving Solaris 2.6 easier setup and administration than its predecessor, improved performance, and a package of solid Internet services. *Page 265.*

LAYER-3 SWITCHING Few things are more confusing than this. Keith Turner takes the mystery out of layer-3 switch architectures in Internet Tools. *Page 269.*

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All files mentioned in this section are available for downloading from our Web site.

ates; firewalls protect your LAN against unauthorized entry. You can also deploy firewalls internally to protect sensitive areas of your network, such as financial and human resources systems.

In the past, firewalls ran on Unix, period. But in recent years, Microsoft Windows NT has become the platform of choice for many network services, and several Windows NT–based firewalls have entered the firewall market. For this feature, we tested five Windows NT–based firewalls from Check Point Software Technologies, Digital Equipment Corp., LanOptics, Raptor Systems, and Ukiah Software. We looked for software-only solutions—as opposed to combination hardware/software products such as Cisco PIX—and required that the products be certified by the National Computer Security Association (NCSA), an independent organization that promotes digital security. Current versions of Global Internet's Centri Firewall, Milkyway's SecurIT Firewall, and Secure Computing's Firewall for NT did not have NCSA certification at the time of testing. Network-1 FireWall Plus and Trusted Information Systems' Gauntlet fit our filter but were between versions when we tested.

We installed, configured, and managed each of the firewalls as you would: assessing remote management, adding and modifying rules, and handling alerts. We set up rules for the entry of packets containing HTTP and FTP, and we experimented with new services such as RealAudio, DCOM, and CORBA. Using ZD WebBench 1.1, we ran performance tests on these products (for more information, see "How We Tested") to see how they would affect throughput on a 100-Mbps Ethernet network. We also ran a host of security tests, primarily using ISS's Internet Scanner 4.3, to see how these products held up against intrusion, denial of service, and other common attacks. Finally, we set up virtual private network (VPNs), which allow secure connections from desktops or laptops outside your firewall and permit secure firewall-to-firewall connections to other offices or even other companies.

In our testing, we found that Microsoft Windows NT–based firewalls do their jobs well. Microsoft has fixed some of the early security holes in Windows NT with service packs, and the firewalls close other holes upon installation. If you make common-sense changes—such as eliminating unnecessary user accounts, changing the administrator account name, and converting the file system to NTFS (as opposed to FAT, which is less secure)—Windows NT can safely handle its firewall chores.

EDITORS' CHOICE

• Check Point FireWall-1

PC MAGAZINE EDITORS' CHOICE

Check Point FireWall-1 stood head and shoulders above the pack. FireWall-1 passed all our security tests with flying colors and proved to be the performance winner, with triple the throughput of its nearest competitor. With its stateful inspection architecture and scripting language, Check Point FireWall-1 also provided the most thorough coverage of basic services such as HTTP and NNTP, and was the most adept at handling advanced services such as RealAudio, Microsoft NetMeeting, DCOM, and CORBA.

FireWall-1 also had the most flexible, complete logging and alerting features of the products we tested. And its Content Vectoring Protocol (CVP) shows promise as a way of integrating the services of third-party products that scan for viruses and misbehaving ActiveX and Java applets.

The other stateful-inspection firewall, Guardian, was not as flexible as FireWall-1 and showed unusual performance results. Of the proxy-based firewalls, Raptor's EagleNT proved to be a powerful security platform whose interface was, unfortunately, very difficult to use. NetRoad Firewall for NT is a decent product that works best for mixed NT and NetWare environments, and AltaVista Firewall 97 is most appropriate for small networks, since it cannot be configured remotely. Surprisingly, all of the proxy-based firewalls proved susceptible to SYN flooding, although Raptor created a patch during our testing to fix the problem.

TWO POSSIBILITIES

The five firewall products divide themselves into two principal architectures. AltaVista Firewall 97, Raptor EagleNT 4.0, and Ukiah's NetRoad Firewall for NT use application proxies. Check Point Firewall-1 and LanOptics' Guardian 2.2 use a technology called stateful inspection.

Application proxies are programs that reside on the firewall and act as both servers and clients. These proxies work at the application layer, accepting connections from a client and making the desired request on the client's behalf to the destination server. Security planners find safety in knowing that every connection runs through a proxy, but often proxies are included only for classic applications such as HTTP, FTP, and SMTP mail, and newer applications are not dealt with effectively. Proxies have a particularly hard time handling UDP, which is found in many newer collaboration and multimedia streaming applications.

With *stateful inspection,* the firewall sits transparently between the inside and outside networks, and it inspects packets at the data link or network layer as they pass through. The firewall is more than a packet filter (which merely examines packet source and destination addresses) in that it can intelligently track sessions between a client and server. For example, the firewall will allow a response to come back from a server only if an authorized request has been made from a client.

We were unable to draw definite conclusions on the performance and effectiveness of stateful-inspection versus application-proxy firewalls, since our two stateful-inspection products had performance results at opposite ends of the spectrum. Check Point FireWall-1 was the best performer, with throughput over three times as fast as that of its nearest competitor. But Guardian—the other stateful-inspection firewall—was the slowest of the pack, because of its unusual stop-and-start operation (see "How We Tested"). All of the firewalls except Guardian proved adequate for anything from ISDN to T1 to 10-Mbps connections. Guardian's performance limits it to T1 connections. Only FireWall-1 should be considered for a 100-Mbps connection, which would most likely be in an internal network.

FireWall-1 also proved to be the most secure. Surprisingly, all the application-proxy–based firewalls were susceptible to SYN flood attacks, but we don't see this as a characteristic of proxy architectures.

In working with these products, we discovered three key requirements for effec-

tive management: the ability to configure and monitor the firewall remotely, flexible methods for alerting administrators to problems, and context-sensitive help. Only FireWall-1 fulfilled all these requirements. By setting filters on alerts, you can decide whether you want to be alerted by a page, by e-mail, or by a visual or audio alert to the firewall's management console. And when you need help, it's useful to find specific help rather than general platitudes that don't help. We found that much of the documentation is guilty of spewing acronyms without explanation, a problem that promotes bad firewall management.

NEW CHALLENGES

All of the firewalls we tested were able to handle packes carrying HTTP, SMTP, and NNTP. But firewalls can no longer get away with just the basics. Users are demanding support for new services and protocols such as those used in multimedia, collaboration, and new distributed applications. Also, networks face new risks from rogue Java applications downloaded from the Web and from viruses attached to e-mail messages or downloadable files.

Multimedia and collaboration applications such as Progressive Networks' RealAudio, Microsoft NetMeeting, and WhitePine's Enhanced CU-SeeMe, often use the User Datagram Protocol (UDP) for some of their functionality. Since UDP doesn't distinguish between request and response packets, and UDP packets are cavalier about the ports they use, firewalls must be very intelligent in order to handle them. The stateful-inspection firewalls usually monitor the TCP control channel to determine which UDP port to let through for the session. Application-proxy–based firewalls need special proxies for this, but often they only have support for RealAudio.

In our tests, FireWall-1 and Guardian had the most flexible UDP options, and EagleNT did a good job by providing a UDP proxy. AltaVista had support only for RealAudio, still the most popular UDP-using application. NetRoad Firewall had both a RealAudio proxy and a generic proxy for UDP and TCP applications.

Newer distributed applications using intelligent ActiveX components or Java applets that can talk to other servers also present challenges for firewalls. These applications often use DCOM or IIOP protocol for this kind of communication. You can handle the situation by setting up generic filters on the stateful-inspection firewalls and generic proxies on the application-proxy–based firewalls. Unfortunately, none of the firewalls provide native support, which means you lose monitoring and reporting capabilities for these services.

Also, viruses and damaging Java applets can cause havoc once they get through a firewall. A simple approach is to stop all files and Java applets, but that's like locking yourself inside your house without food. Firewalls are natural places to scan for these dangers, and they are becoming more clever about this. FireWall-1 and EagleNT can hand off suspect files to a special third-party server to check for viruses or rogue applets. Products such as Finjan's SurfinGate and Symantec's Norton AntiVirus for Firewalls are emerging to protect against Java applets and viruses, respectively.

PRIVATE CONNECTIONS

Each of the firewalls we reviewed offered a way to set up encrypted sessions, called virtual private networks, with other firewalls or individual users. VPNs use a combination of authentication, encryption, and message integrity to create connections over the Internet. Authentication methods range from simple user-name and password authentication to secure cards such as the AssureNet Pathways' SecureNet Key and Security Dynamics' SecurID cards.

VPNs can provide secure connections between two remote offices. By using the Internet as a backbone, companies can save more money than with other approaches, such as frame-relay networks.

Individuals can also take advantage of VPNs. Whether they are on the road or at a remote location, users can securely connect over the Internet to resources on their networks (such as Web or mail servers) by using special VPN client software. These desktop-to-firewall solutions are inexpensive alternatives to the more traditional remote-node access methods.

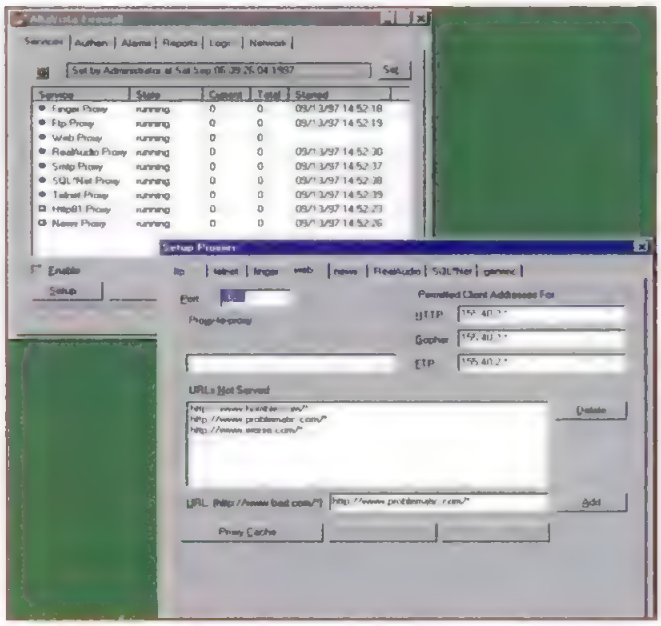
Although firewall vendors are beginning to claim VPN interoperability, our tests still suggest that a single-vendor approach is preferable, based on still-emerging and incomplete implementation of standards such as IPsec and SKIP.

Microsoft Windows NT firewalls are quickly becoming mainstream network-security solutions. Read ahead to see which one will work best for your network.

Digital Equipment Corp.

AltaVista Firewall 97

AltaVista Firewall 97 is a true application-proxy–based firewall with a straightforward management interface and a complete set of basic services (starting at $3,995 for 50 users). Excellent documentation explains each proxy configuration. But the lack of remote configuration capabilities and the inability to work with more than two-adapter configurations make this product most suitable for small networks. AltaVista's DNS and SMTP proxies have the most to offer, but its HTTP proxy is missing some minor features. A separate Digital Equipment product called Tunnel 97 ($995 for a server and 10 clients) provides VPN connections for desktop PCs, laptops, and other Tunnel 97 servers.



ALTAVISTA FIREWALL 97'S *tab-based interface is easy to use, but the product has no remote management capabilities.*

AltaVista's performance was in line with the other application-proxy–based firewalls, but, as with the Raptor and Ukiah products, our security tests found this firewall to be vulnerable to SYN-flood attacks.

AltaVista has solid support for most of the

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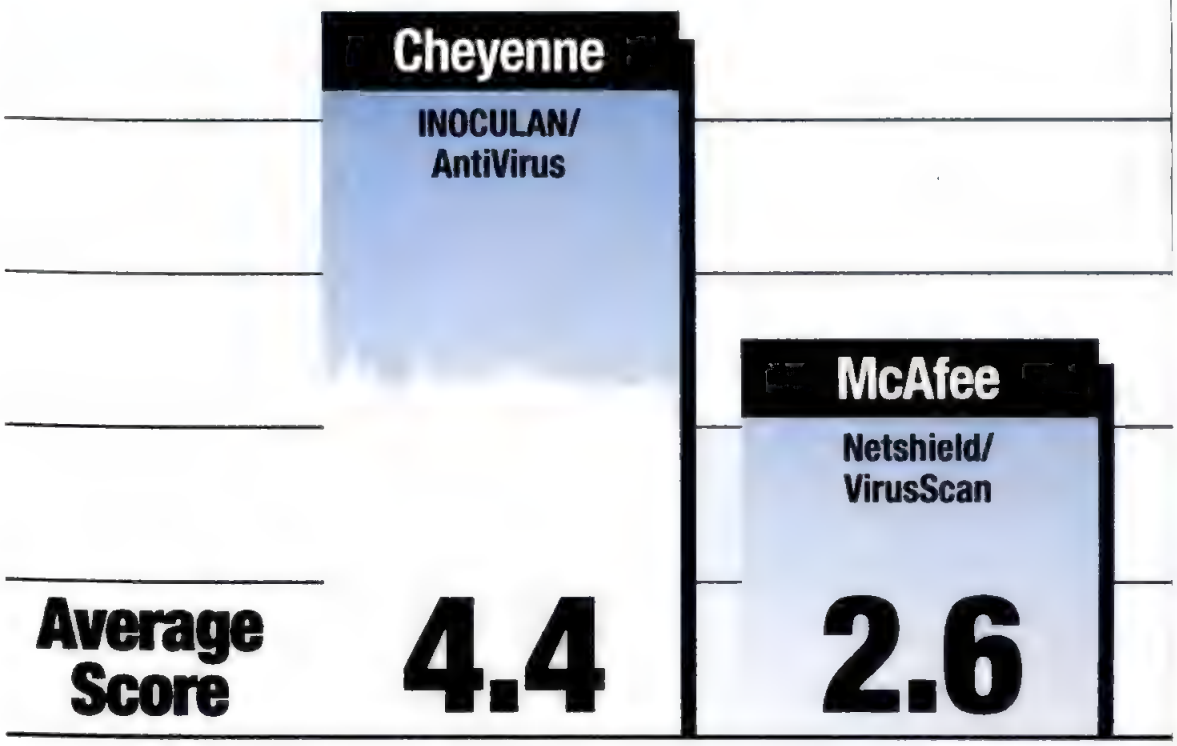

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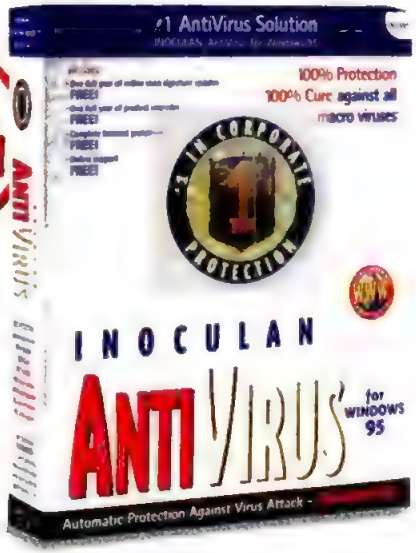

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* Based on tests conducted by the Computer Associates Virus Research Center. ** Prices shown are U.S. estimated street prices and may vary at your local retailers.

CIRCLE 032 ON READER SERVICE CARD

basic services, except for some minor deficiencies with HTTP. Although the HTTP proxy includes a configurable cache for improving performance, the firewall provides no alarms or useful reports for HTTP, nor is there a proxy for Secure Sockets Layer (SSL). You can use a generic many-to-one proxy to make a Web server inside the firewall accessible to outside users. An included SMTP mail proxy protects SMTP mail hubs on the internal network.

As with all the products except Guardian, telnet and FTP access can be finely regulated: You can require that users authenticate themselves, restrict users to FTP gets (reads), and block puts (writes). You can also check user names and passwords against a Windows NT domain, or authenticate users with authentication devices such as CryptoCards.

Beyond the basic services, AltaVista includes a RealAudio proxy for streaming audio that works with both TCP and UDP RealAudio sessions on port 7070. A SQL*Net proxy, unique to this product, is useful for replicating Oracle databases across the firewall, and a generic TCP proxy can be used to add new TCP protocols such as POP3 and IMAP4 for mail access. However, no generic UDP proxy is included, so passing protocols such as those used for Microsoft NetMeeting or many videoconferencing solutions is out of the question.

For other, newer services, such as DCOM and CORBA, you can build generic proxies using source and destination addresses along with the port number of the application. However, the generic proxies cannot delve into the data portions of packets and provide no useful reporting.

Similar to the other products in this roundup, AltaVista does not provide any way to inspect Java applets or downloaded files for viruses. And unlike Checkpoint, Digital Equipment hasn't built in any integration points for third-party products that provide that functionality.

An easy-to-use Windows management interface provides access to all configuration parameters. Alerting, monitoring, and logging are available for most of the proxies, excluding HTTP. AltaVista changes the Windows NT console wallpaper from green to yellow to orange, and finally to red, to indicate a problem. You can monitor (but not configure) the firewall securely from a Web browser, but you first have to install IIS 2.0 on the firewall server.

On installation, AltaVista tightens up the underlying Windows NT operating system. The installation prompts you to change the user name and password of the admin account, disables various services, and recommends disabling all unused accounts, including the guest account. The manual also suggests additional ways to lock down the Windows NT server to prevent attacks.

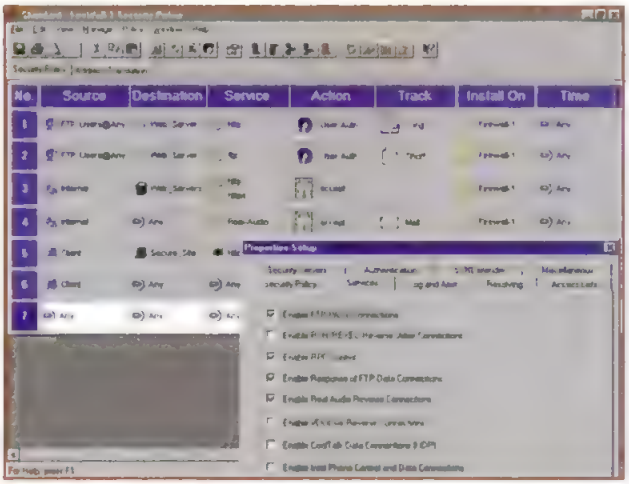
AltaVista Firewall 97 3.0. List price: 50 nodes, $3,995; unlimited nodes, $14,995; Tunnel 97, server and 10 users, $995. Digital Equipment Corp., Maynard, MA; 800-336-7890; fax, 508-486-2017; www.altavista.software.digital.com. *Circle 961 on reader service card.*

Check Point Software Technologies Ltd.

Check Point Firewall-1

PC MAGAZINE EDITORS' CHOICE

Check Point's leading status in the firewall market is richly deserved. Top-notch performance, a complete set of services, solid security, and excellent management and logging features stand FireWall-1 head and shoulders above the other products in this review and earned it our Editors' Choice. FireWall-1 (starting at $4,995 for 50 users) passed all our security tests and finished with the best performance scores by far.



CHECK POINT FIREWALL-1'S *Security Policy window provides an overview of the rules you have defined.*

Check Point redefined the way people think about firewalls with its stateful-inspection engine, which works at the network layer, unlike classic application-proxy–based firewalls that operate at the application layer. Together with FireWall-1's scripting language, stateful inspection makes it easy to add new services as they emerge. Stateful inspection has proven especially useful for multimedia and collaboration services such as RealAudio, VDOLive, and Netscape Conference, which use a mixed bag of UDP and TCP packets. UDP is a challenge for application-proxy–based firewalls. Guardian is the only other product in this review that uses stateful inspection.

Firewall-1 comes with all of the basic services, including HTTP, SSL, NNTP, SMTP, and DNS. Administrators can control each of these services using flexible rules. You can create rules to accept, reject, or drop different combinations of source, destination, and service types. You can also define network objects—either hosts, networks, or groups of the same—and use them to populate the source and destination fields in the rule base. You can also use rules to require authentication, track invocations of the rules, and set time-of-day restrictions.

As with the other firewall products except Guardian, you can place specific restrictions on individual FTP sites and directories, and you can selectively allow gets but not puts. This feature prevents users from writing out company data to an external server. For the Web, administrators can deny users the ability to use Post or Put—HTTP techniques for filling out forms and writing files to Web servers—and for SMTP, you can place restrictions on the size of the message. A rule-verification feature intelligently runs through your rules to see if any are hidden by previous rules.

Higher value comes from adding specialized third-party products that go beyond Check Point's basic Java blocking capabilities, by checking for viruses or rogue Java applets, or by applying some kind of rating-service filter. Check Point has developed what it calls the Content Vectoring Protocol (CVP), which defines how a firewall forwards packets and data to these specialized servers.

An administrator can configure and monitor Firewall-1 on the firewall itself or from anywhere on the network.

Firewall-1 displays the most complete and flexible logging facility of any product in our review. You choose a simple or verbose log entry on a rule-by-rule basis, and the log viewer can sort and select the log entries in many ways. Any event, such as an unauthorized user on the external network trying to get to

Windows NT Firewalls

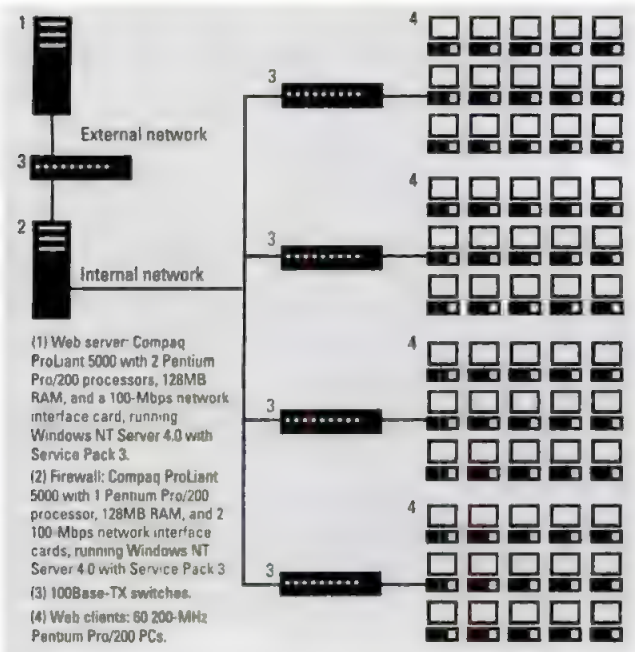
Check Point FireWall-1 vastly outperformed the other products and passed all of our security tests. Guardian's performance indicates that it is appropriate only for T1 connections. The others performed adequately for 10-Mbps connections. Only Firewall-1 is suitable for 100-Mbps connections.

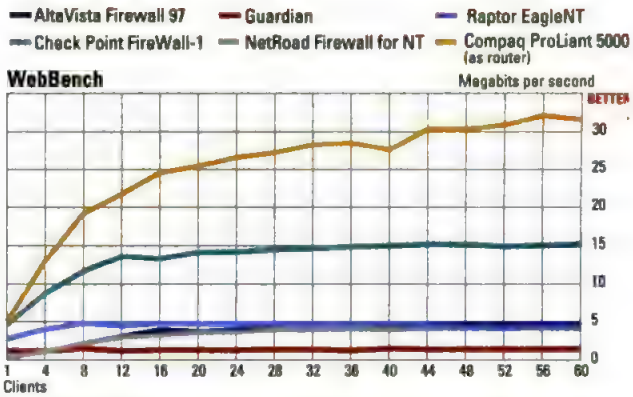
What the Numbers Mean

The products here use two principal techniques for protection: application proxies and stateful inspection. We hoped our tests would determine which method is superior, but a clear winner is not obvious. The two stateful-inspection firewalls showed drastically different throughput: FireWall-1 was the best performer and Guardian was the worst. We were particularly impressed that FireWall-1 does not seem to sacrifice security for speed.

Check Point's invocation of stateful inspection uses what the company calls an Inspection Virtual Machine, which sits below the Windows NT kernel between the network layer and data-link layer of the protocol stack. By catching packets this far down the stack, stateful inspection avoids having to pass potentially dangerous packets to the OS. Instead the virtual machine communicates with the OS resident rule base to determine if a packet should pass.

LanOptics claims that Guardian goes farther down the stack with its stateful inspection, giving hackers even less to work with. Unfortunately, Guardian performed poorly. It handled requests inconsistently, honoring many requests for a few minutes and then stopping completely for the next few minutes. LanOptics sent a technician to PC Labs, but he was unable to diagnose the problem in the time available. The vendor expects to have a fix available shortly.





An application proxy acts as a traffic cop by stopping all incoming traffic at the firewall, checking its legitimacy, and recreating the traffic on the users' behalf. All the application-proxy–based firewalls performed similarly, hovering around the 5-Mbps level.

The security results are interspersed throughout the reviews. The most common hole we found was susceptibility to a SYN flood attack. This attack let us deny service on the attacked ports with AltaVista Firewall 97, NetRoad Firewall for NT, and Raptor EagleNT (Raptor was able to provide a fix that should be available to customers soon). We uncovered one other hazard during testing: Adding Service Packs to Windows NT may introduce new security holes. Representatives of Raptor felt that its SYN-flood problem was because of a SYN/ACK timing issue that was introduced by one of the service packs.

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Go to PC Magazine Online to access these test results with our exclusive interactive test results viewer

How We Tested

The security test-bed consisted of a few clients and a number of servers running services such as DNS, FTP, HTTP, and RealAudio. Our main tool for discovering holes was ISS's Internet Scanner 4.3, which launches numerous well-known attacks in order to discover vulnerabilities in networks and firewalls. We allowed Internet Scanner to perform heavy security sweeps while clients were simultaneous passing the services through the firewall.

Our throughput test-bed used 60 Dell Pentium Pro/200 machines in a 100-Mbps switched network on the "inside" of the firewall. On the "outside," simulating the Internet, we placed a Compaq 5000 ProLiant with Windows NT 4.0 and IIS 3.0. Another ProLiant 5000 with a Pentium Pro/200 processor, 128 MB of RAM, and two Intel EtherExpress PRO/100B NICs held the firewall software. All Windows NT servers in both security and performance testing had Service Pack 3 installed. We used WebBench 1.1 to simulate as much HTTP traffic as can be squeezed from 60 machines. WebBench places a mix of different-size HTML pages on the Web server, and then lets clients request those pages in a predefined distribution as fast as they can.

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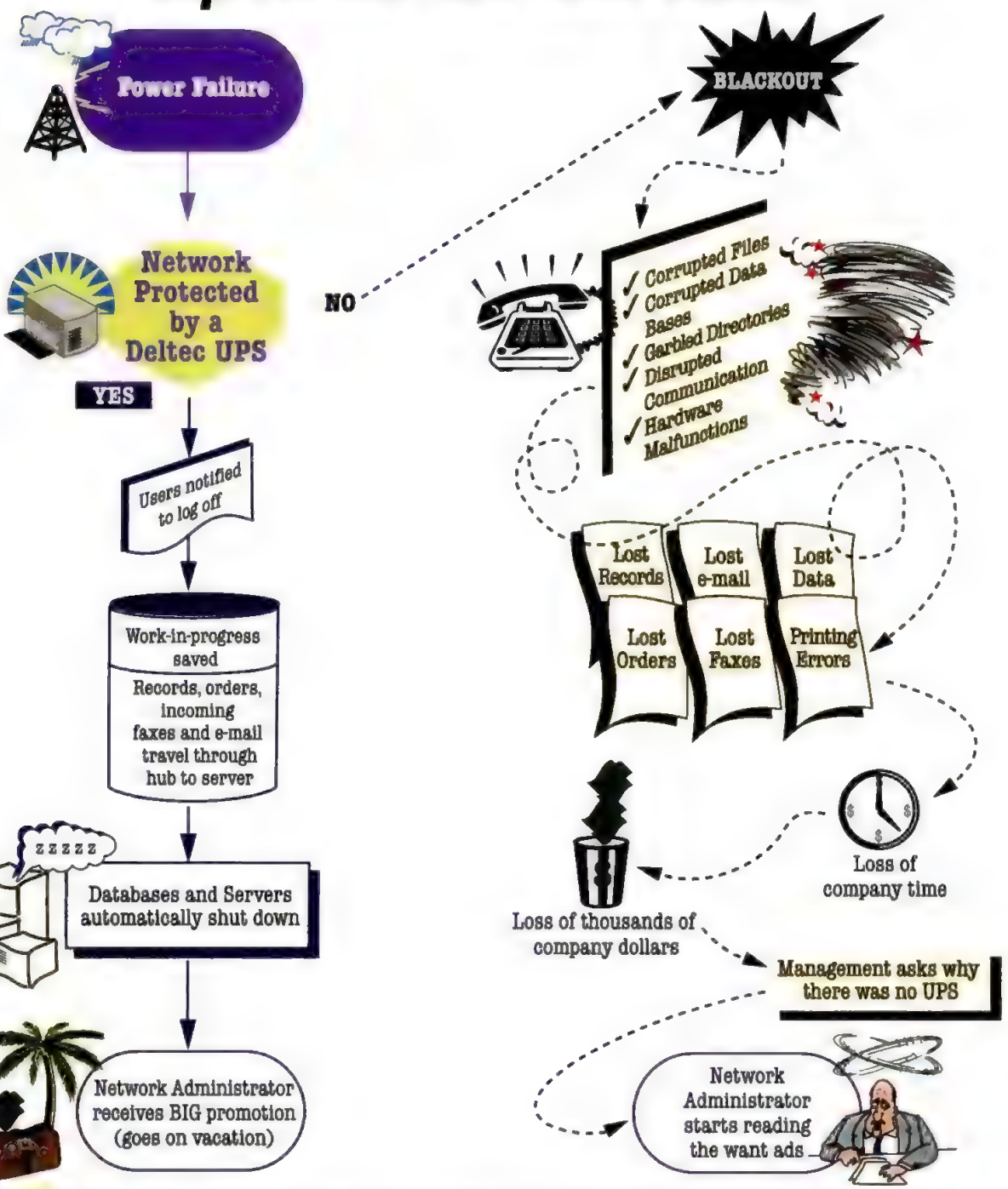

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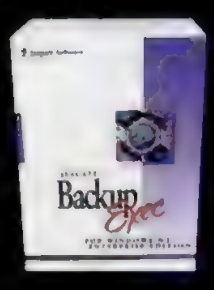

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an internal Web server, can trigger a visible or audible alert to the System Status screen or one of many other options, such as an e-mail, pager alert, or log entry.

Firewall-1's optional encryption module turns the firewall into a VPN node. You have the choice of DES or FWZ1 encryption to connect two or more firewalls together for a virtual private network over the Internet. For connecting to other vendors' firewalls, manual IPsec is included.

In addition, Microsoft Windows 95 or Windows NT desktops or laptops using SecuRemote software (free with purchase of Firewall-1 and encryption module) can connect securely to the firewall. Dynamic TCP/IP addresses are allowed as the authentication can be based on a user using standard user-name password or SecurID or Accent Technologies' security tokens.

Check Point Firewall-1 3.0. List price: 50 nodes, $4,995; unlimited, $18,990; encryption, $2,995. Check Point Software Technologies, Redwood City, CA; 800-429-4391; fax, 650-562-0410; www.checkpoint.com. *Circle 962 on reader service card.*

LanOptics Inc.

Guardian

If you're looking for an inexpensive firewall that covers all the basic services and has excellent real-time monitoring capabilities, take a look at Guardian 2.2 ($3,980 for 50 clients). In addition to providing information on your firewall status, Guardian can tell you the bandwidth usage of your link to the outside, a feature unique among the products we tested. However, Guardian's performance results, while acceptable for a typical T1 connection, were the worst of the products we tested, and the product is missing many of the advanced features provided by Check Point FireWall-1, Raptor EagleNT, and Ukiah Software's NetRoad Firewall for NT. Like AltaVista Firewall 97, Guardian is limited to dual-adapter–firewall configurations, so you can't use it for a DMZ layout in which you provide one class of protection for your Internet Web server and another for your internal network. Guardian doesn't have specific provisions for advanced services, such as SSL and RealAudio, and it doesn't provide e-mail or pager alerts; to see an alert, you have to be watching the particular console screen in which the alert is being generated. This makes Guardian, at best, most appropriate for smaller networks.

Guardian passed all our security tests, but its performance results hovered near 1.5 Mbps regardless of the number of clients we used. After attempting to help us determine the reason for these strange results, LanOptics concluded that the results had something to do with the Compaq ProLiant 5000 we were using. We didn't run into these problems with any of the other firewall products we tested, however, and when we substituted a Dell server for the Compaq the results were similar.

LanOptics refers to Guardian's architecture as MAC Layer stateful inspection, which is similar to Check Point FireWall-1's stateful-inspection architecture. In addition to doing the standard packet filtering by source and destination, the product looks for additional information or state, such as packet size, port address, and network protocol, to determine whether activity is secure.

Two software components make up the firewall: Guardian Agent and Manager. Agent runs on NT Server or Workstation, and Manager does all security administration. Manager can reside on any desktop PC with Windows 95 or NT, or on the same system as Agent. Network Address Translation (NAT) is available (with the appropriate license) to protect the identity of IP address's from the outside world.

We didn't have any difficulties setting up rules policies, referred to as Strategies, for fundamental protocols and network services such as HTTP, FTP, telnet, and UDP. Guardian provides a multicolumn layout similar to FireWall-1 for configuration. Its simple click-and-add screens let you add network objects, select services, and define actions. You can tag traffic types to allow, authenticate, ignore, or reject activity and click off alerting and logging capabilities. Further rules can designate the time, day of the week, and available bandwidth. For firewall novices, Guardian provides a walk-through wizard that is unique to this product.

SUMMARY OF FEATURES

Software Firewalls

	AltaVista Firewall 97	Check Point Firewall-1	Guardian	NetRoad Firewall for NT	Raptor EagleNT
List price for unlimited users	$14,995	$18,990	$6,980	$14,995	$15,000
Recommended processor	Pentium Pro/200	Pentium Pro/200	Pentium/133	Pentium/200	Pentium Pro/200
Recommended RAM/disk space	132MB / 1GB	48MB / 100MB	32MB / 1GB	32MB / 1GB	64MB / 1GB
Dual-adapter/Multi-adapter	■	■	■	■■	■■
IPX-IP gateway/NAT	■	■	■	■■	■
Firewall Techniques					
Packet filtering/Stateful inspection	■	■	■■	■	■
Application proxy/Circuit gateway	■■	■	■	■■	■■
Management and Reporting					
Remote administration	■	■	■	■	■
Multiple-firewall control		■	■	■	■
Monitors active connections	■	■	■	■	■
Monitors suspicious events	■	■	■	■	■
Restricts access by time/application	■■	■■	■■	■■	■■
Restricts access by bandwidth	■		■		
Authenticates remote clients	■	■	■	■	■
On-screen/e-mail alerts	■■	■■	■	■■	■■
Pager/SNMP alerts	■	■■		■■	■■
Logs source/destination	■■	■■	■■	■■	■■
Logs time/service/alerts	■■■	■■■	■■■	■■■	■■■
Logs attacks/history/action	■■■	■■■	■■■	■■■	■■■
Services Supported					
FTP/HTTP/NNTP	■■■	■■■*	■■■	■■■	■■■
DNS/POP3/telnet	■■■	■■■	■■■	■■■	■■■
Netmeeting/RealAudio	■	■■	■■	■■	■
SSL/UDP	■■	■■	■■	■■	■■
Security					
Create VPNs using IPsec/SKIP		■■	■■		■
DES/RC4	■	■	■■		■■
S/Key authentication	■	■	■	■	■
Scans for viruses		■			

* If implemented without content screening

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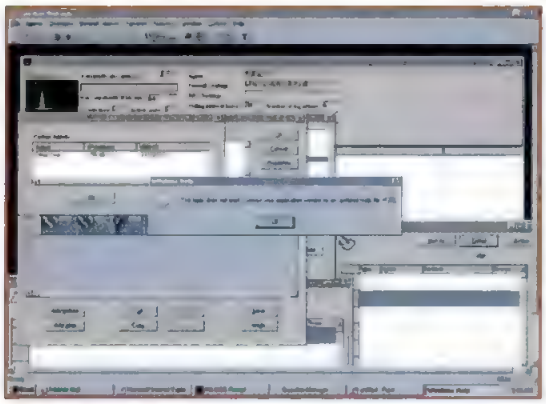
Though setting up rules is easy, implementing them is a trial-and-error affair, as there is no rules verifier for testing like those found in NetRoad Firewall for NT or Firewall-1. In addition, new network services are added only by source, destination addresses, and port numbers, thereby limiting their effectiveness compared to the existing services that examine state information. And Guardian doesn't offer rules for some newer but important services, such as NetMeeting or handling ActiveX or Java.

VPN setup is not difficult. You merely need to know your partner's Agent ID and IP address. For implementing the VPN, LanOptics uses the Manual IPsec protocol with S/Key for authentication and RC2/RC4 encryption.



WE FOUND GUARDIAN'S *Help screen examples almost unreadable.*

Guardian 2.2. List price: 50 users, $3,980; unlimited users, $6,980; $100 per user for S/Key authentication (price reduced with multiple users); NAT unlimited users, $1,980. LanOptics Inc., Carollton, TX; 800-533-8439; fax, 972-738-6999, www.ntfirewall.com. *Circle 963 on reader service card.*

Ukiah Software Inc.

NetRoad Firewall for NT

Aimed squarely at networks running a blend of NetWare and Windows NT, NetRoad Firewall ($3,295 for 50 users) offers two features that are unique among the products in our review: management through NetWare Directory Services (NDS) and an IPX/IP Gateway to allow Internet connectivity for NetWare clients. Non-NDS networks forfeit NetRoad Firewall's remote management capabilities. Ukiah offers no VPN solutions, but instead suggests using third-party hardware.

NetRoad Firewall for NT fared similarly to the other proxy-based firewalls in our performance tests, indicating that it can easily satisfy T1 and 10-Mbps connections but cannot scale for 100-Mbps backbone configurations. Just as in our security tests with the products from Digital and Raptor, NetRoad Firewall is susceptible to SYN flooding; the product can generate an alarm in response but cannot shut itself down.

NetRoad Firewall offers multiple methods of protection, including packet-filtering and transparent-proxy services. As with Guardian or FireWall-1, built-in Network Address Translation (NAT) protects internal IP addresses by making a single address viewable to the public network. Ukiah covers the basics for common applications and protocols, including NNTP, SMTP, POP3, and DNS. As with the other application-proxy–based firewalls, mail-address protection in the SMTP service makes a nonspecific name visible; so an address that contains, for example, references to Human Resources or to Accounting doesn't grab the attention of potential attackers. You can forward DNS requests outside the firewall, but the product doesn't supply its own DNS, as do AltaVista and EagleNT.

As with the other firewalls except Guardian, NetRoad Firewall lets you configure HTTP, FTP and telnet down to the command level, allowing, for example, puts but not gets. FTP clients offer an authentication option, and HTTP implementations can explicitly block specific URLs. There is no HTTP caching, however, for enhancing performance, as there is in AltaVista.

When it comes to more advanced services, NetRoad Firewall has proxies for RealAudio and SSL, and can block PointCast traffic; but we were unable to get the RealAudio proxy to work. As with EagleNT, generic and custom proxies are present for adding UDP and TCP applications, including DCOM and CORBA. You can't, however, create proxies for applications that mix UDP and TCP, such as NetMeeting. Also, there is no current method for filtering or blocking Java and ActiveX, though links to enable the CVP-

SUITABILITY TO TASK: WINDOWS NT FIREWALLS

	AltaVista FireWall 97	Check Point Firewall-1	Guardian	NetRoad Firewall for NT	Raptor EagleNT
Management and reporting	Fair	Excellent	Good	Fair	Fair
Basic services	Fair	Good	Fair	Fair	Fair
New challenges	Fair	Excellent	Fair	Fair	Fair

Management and reporting We test each product's configuration, monitoring, and reporting tools. We look for a straightforward interface, the ability to fine-tune configuration easily, and clear documentation. We give extra points to products that come with tools for validating the efficacy of user-defined configurations. We also look for flexible alerts via pager, e-mail, and traps to an SNMP management console in response to attacks. We look for a complete and flexible set of monitoring and reporting tools, with the ability to sort and select entries in several different ways. Finally, we look for the ability to manage the firewall not just locally but from across the LAN and even across the Internet.

Basic services We look at the product's ability to deal effectively with HTTP and SMTP, which constitute most Internet traffic today. We also consider the product's results on our performance and security tests. To round out basic services we look at news (NNTP), File Transfer Protocol (FTP), and telnet capabilities. We give extra points to firewalls that can limit users to FTP gets while disallowing puts, restrict access to defined URLs in HTTP requests, require authentication for some sites, and check for bad SMTP message commands. We also look for products that offer caching HTTP proxies to improve performance and include Domain Name Service. Finally, for the stateful-inspection products, we require network-address translation.

New challenges Security administrators face a whole set of new challenges that come from the wish to take advantage of all the Internet has to offer. New collaboration and multimedia-streaming applications such as Microsoft NetMeeting, Netscape Conference, and VDO play havoc with traditional proxy-based firewalls. Most of these new applications use the User Datagram Protocol (UDP), the bane of anyone who cares about security. Also, new custom applications introduce challenges, as many of them use protocols like DCOM and CORBA. We looked for firewalls that can handle these new challenges with generic proxies, generic filters, or scripting languages. We also look for virtual private-network capabilities to provide secure firewall-to-firewall connections and to let remote users connect securely back to the network over the Internet. Finally, viruses and bad Java applets can devastate your network. While most firewalls can be set up to block ActiveX and Java applets, we look for the ability to pass mail attachments and file downloads to servers' third-party products that can scan these files for security problems.

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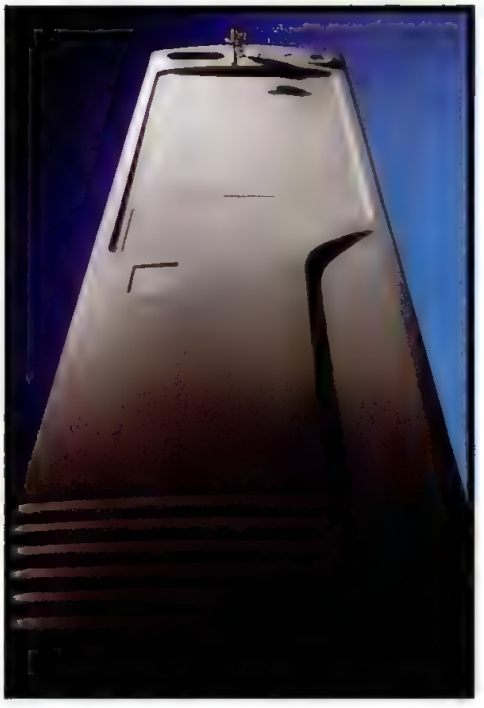

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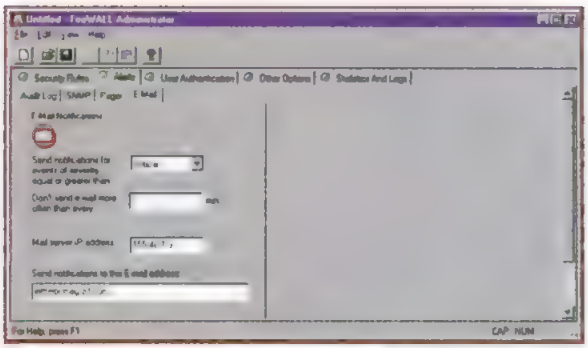

NETROAD FIREWALL FOR NT *offers comprehensive alerts via audit logs, SNMP pager, and e-mail.*

protocol–based products should be available in the next release, according to Ukiah.

Our installation was uneventful. While EagleNT and AltaVista disable potential security holes present in Microsoft Windows NT, NetRoad Firewall only recommends that the default gateway for your internal-network connection be removed during setup.

NetRoad Firewall's management console is clear and uncluttered. Dialog boxes are simply laid out and easy to access, and navigation is streamlined compared to EagleNT. We had no difficulties setting up rules, and we liked the built-in validation tool that lets you know when you've made a mistake or have incomplete information. Notification is as comprehensive as any product in our review, with pager, e-mail, on-screen, and SNMP options.

All user information can rely on NDS or Windows NT Domains. At first glance, this feature seems like a good way of avoiding repetitious entry of existing information. It potentially opens up internal security risks, however, if clear-text–password interception takes place.

Unlike FireWall-1, which contains extensive sorting criteria for report logs, all views of information are preset, allowing little flexibility. In all, NetRoad Firewall for NT is a decent solution for mixed NetWare/NT networks running NDS.

NetRoad Firewall for NT 1.1. List price: 50 users, $3,295; unlimited users, $14,995. Ukiah Software Inc., Campbell, CA; (800) 988-5424; fax, (408) 369-2899; www.ukiahsoft.com. *Circle 964 on reader service card.*

Raptor Systems Inc.

Raptor EagleNT

Raptor clearly has thought about most of the protocols and services its firewall might encounter. Raptor EagleNT ($3,995 for 100 users) comes with proxies for all of the basic services and lets you create generic proxies for both TCP and UDP services. The problem with EagleNT stems from its very difficult and quirky user interface. Raptor has made no allowances for Microsoft Windows NT conventions, and in many cases, fighting with its Unix-like interface diverts your attention from the function at hand.

EagleNT came in second on our performance tests, but it still finished far behind Check Point FireWall-1. Our security tests found the product to be vulnerable to SYN-flood attacks, although Raptor was quick to create a patch that it has promised to make available on its Web site.

EagleNT handles standard protocols via proxies and a series of rules that the firewall administrator sets up. The firewall can work both as an explicit and a transparent proxy. With an explicit proxy, clients such as Netscape Communicator and Microsoft Internet Explorer are configured to use a proxy. In transparent mode, clients are unaware of any proxies but must be configured with the proxy as the default gateway. EagleNT intercepts the packets and makes the request on behalf of the client. All the other firewalls except AltaVista use transparent proxies.

You can set up rules using the default Net Entities—standard sets of objects labeled Universe, Inside, and Outside, which are created upon installation. Or you can create your own hosts or networks. The entire set of rules is compiled by the firewall. You must remember to update each rule, and you must save changes before your changes take effect. You can expose internal servers to external resources, or you can choose to hide the actual host name and TCP/IP address of the internal server by using EagleNT's unique redirection (or reverse-proxy) feature. You can also use redirection to map all requests for a given service to a specific server. Like Alta Vista, Raptor includes a DNS server with the firewall.

For services not covered by the standard proxies, such as CORBA and IIOP, administrators have to use the Generic Server Passer (GSP). Generic proxies are available for TCP and UDP, with UDP proxies limited to many-

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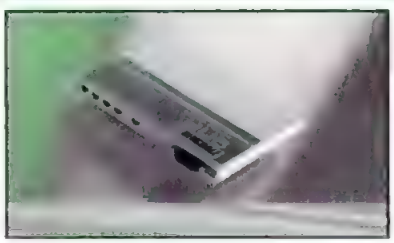

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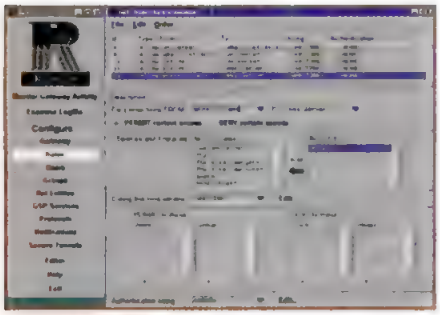
to-one connections. For protocols not amenable to proxies, such as NetMeeting and other complex protocols, you can use local tunnels to create simple packet filtering. You have to treat users using tunnels differently, as they bypass the proxies; this method is better than not having any ability to filter, but it's clumsy compared with what you can do with Check Point FireWall-1's rules.

EagleNT's configuration interfaces are simple ports from their Unix cousins. You can't use the arrow keys to scroll down lists, and critical buttons are hidden from view if the Windows are not maximized, which is a distraction. You can monitor sessions, examine log files, and set up alerts in the form of e-mail, pager, or audible and visual notifications.

Raptor has an optional VPN package ($2,500 when purchased with EagleNT) for



RAPTOR EAGLENT'S *interface looks more like Unix than Windows NT.*

secure firewall-to-firewall or remote-desktop connections. The secure tunnel bypasses the proxies, so Raptor has added packet filtering back in to modify the available resources for those connecting in through a VPN. Raptor offers client software called EagleMobile, supporting dynamic TCP/IP addresses not only for Microsoft Windows NT and Windows 95, but for Windows 3.11 as well. You can use most popular authentication schemes, including passwords, tokens, and smart cards.

Like AltaVista, EagleNT takes measures to protect the Microsoft Windows NT Server. The server and other services are disabled, as are nonadministrator accounts. In our minds, because of its Unix-like interface and complexity, EagleNT doesn't make the best choice for a small to medium-size company wanting a Microsoft Windows NT–based firewall. But if you are using Raptor's Unix-based product and feel comfortable with a Unix-based interface, you'll feel right at home.

Raptor EagleNT 4.0. List price: 100 users, $3,995; unlimited users (including VPN and Hawk), $15,000. Raptor Systems Inc., Waltham, MA; 800-932-4536; fax, 617-487-6755; www.raptor.com. *Circle 965 on reader service card.* PC

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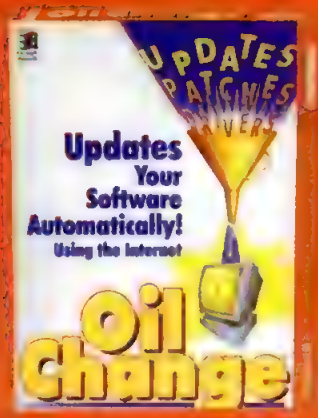

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FROM THE BENCH

SUN SOLARIS 2.6

Something New Under the Sun

By John Garris

When it comes to Unix, there's no middle ground. You either hate its cryptic and unforgiving command line interface or love its proven scalability and reliability. Though the Sun Solaris 2.6 ($695 list for five users) isn't likely to convert you from a Microsoft Windows NT devotee to a Unix stalwart, Sun Microsystems' Unix-based OS is making inroads in recapturing the application server market.

The product still lacks the overall ease of use of Windows NT, but its fast performance (see "Fast Web Services" in this story), smooth installation, and greater Java integration make it a formidable contender. And as an added bonus, Solaris 2.6 comes with the Java Virtual Machine Version 1.1, Sun's Java runtime environment, which includes the Java compiler, Java interpreter, Java class file disassembler, and other utilities. We tested Solaris 2.6 on the Sun SPARC platform. Just as we went to press, Sun Microsystems released its Intel-based version.

Though you can buy the base operating system on its own, you may want to consider Solaris for Intranets ($1,290 list for five users). Designed for workgroup intranet environments, Solaris for Intranets comes with the Solaris 2.6 CD, as well as an impressive suite of additional products—including Sun's WebServer; Solstice Internet Mail Server; SunScreen SKIP (Simple Key Management for Internet Protocols), which lets you create virtual private networks; and SunLink, which permits file sharing and print services for Macintosh and PC desktops. Solstice Internet Mail Server previously won an Editors' Choice ("Behind the IMAP Rap," *PC Magazine*, Network Edition, May 27, 1997).

EASY INSTALLATION, TOUGHER ADMINISTRATION

A well-circulated Unix myth is the difficulty of installing and configuring the OS. But Solaris's new Java-based installation utility, WebStart, makes it easy. To run WebStart, we simply inserted the CD, turned on the computer, and typed "boot cdrom—browser." WebStart did the rest: It installed Solaris and the documentation, as well as all the additional Solaris for Intranets products. We were also given options to set our partition sizes or to accept the default settings. The whole process took about 2 hours.

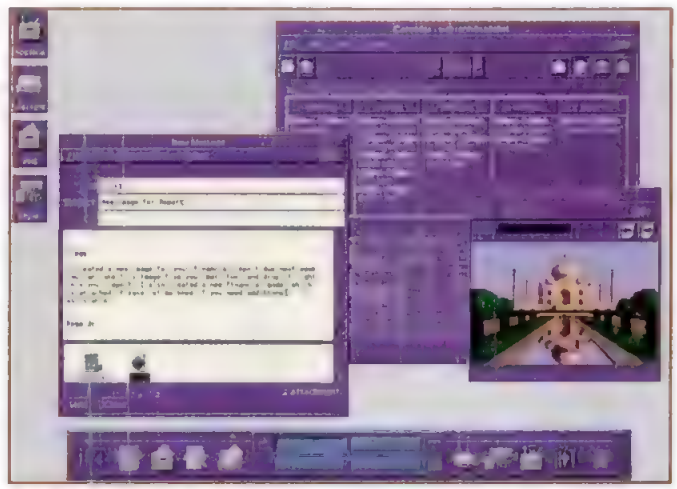
WebStart does have a distinct flaw, though. It can perform only fresh installations, not upgrades of existing systems. For upgrades, we used Solaris's conventional installation utility, which is just as easy to use but installs only the operating system. This utility checks and updates your system's software and can automatically repartition your file systems if any of them need extra hard disk space. We found this feature especially useful, since manually repartitioning hard disks can be an arduous, time-consuming task.

Though installing Solaris 2.6 may defy the Unix myth, administering it does not. Despite the fine user interface, getting around is tough without a basic understanding of Unix. Sun Microsystems has attempted to make Solaris easy enough for workgroup environments, but Windows NT retains a distinct usability edge. Network administrators configure Windows NT servers using a series of graphical dialog boxes. Solaris 2.6 still requires administrators to perform many tasks, such as configuring network settings or adding hardware devices, from the Unix command line.

Solaris does do some things better than Windows NT, however. For example, Solaris' ubiquitous telnet program (for which Windows NT substitutes the more temperamental Hyperterminal feature) gives you full power to configure servers from virtually any machine connected to the network. And since most system configuration changes don't require rebooting (unlike with Windows NT), keeping Solaris servers running is much easier.

Sun Microsystems' long-term strategy to ease Solaris administration is moving as many functions as possible to Java. Toward that end, Solaris includes Sun's HotJava Web browser as well as WebStart. With HotJava, you can view Solaris's AnswerBook2 documentation and configure some of the bundled Solaris for Intranets applications. We did find HotJava slow though easy to use. Browsing the Solaris documentation from a networked PC running the Netscape Navigator browser was quicker and more convenient.

Sun Microsystems has also kept its provision for X Window users in Solaris 2.6 with the default Common Desktop Environment (CDE). Although you can still use Sun's OpenWindows graphical environment, CDE gives Solaris a look and feel similar to Hewlett-Packard's HP-UX, IBM's AIX, and SCO's UnixWare, which also implement CDE.



ONE OF THE BOYS: *Solaris 2.6's Common Desktop Environment (CDE) gives it the look and feel of other popular Unix flavors.*

SOLARIS FOR INTRANETS

Of the bundled Solaris for Intranets applications, SunLink and TotalNet Advanced Server (TAS) are two of the most impressive. With SunLink, the Solaris server looks just like a NetWare or Windows NT server; you can configure users and groups and map file system privileges to those users. TAS lets Macintosh users treat a Solaris server like a normal Windows-based file and print server.

We did find a few bugs when testing the product, however. For example, TAS got confused when we renamed a folder from a Windows 95 client and then tried to create a new folder with the old name; it wouldn't let us perform the operation. Furthermore, it costs an additional $40 per user on top of the bundle's price. But we found it a convenient way to give PC LAN users access to Unix files without resorting to installing NFS on each client PC or establishing an FTP session.

CROSS TALK

"Leon, the anything-but-Microsoft faction finally has something to rally around besides Linux. Solaris 2.6 is a legitimate, powerful, and full-featured operating system with no rough edges. John Garris did a good analysis, but I think it has an important future on Intel, too. I've installed Solaris on Intel machines and had no problems."

"Also, Frank, Solaris 2.6 is the basis of Sun's move toward controlling the cost of computing. Solaris 2.6 is all set to boot up Sun's NCs. In view of Sun's gangbuster e-mail and network management platforms—plus its enthusiastic participation in directory service developments—Solaris is a serious contender for the foundation of a large or small enterprise."

We also liked Sun's WebServer 1.0, and our performance tests showed it to be faster than some of its competitors. On a previous test of Solaris-based Web servers ("Beyond Unix," *PC Magazine*, May 27, 1997), we encountered some latency issues between Sun's TCP stack on the server and Microsoft's TCP client stack. In this latest version of Solaris, Sun seems to have eliminated the problem. Its Web-based administration tools are good. But for more advanced features such as content management, high-speed development interfaces (instead of CGI), or LDAP user management, you should consider another Web server.

Solaris for Intranets also comes with Solstice Internet Mail Server 2.0, which supports IMAP, POP3, and SMTP. The product's IMAP capabilities let e-mail clients running on Solaris, Windows 3.*x*/95, or Windows NT access and manipulate messages without downloading them to the client computer.

The suite includes SunScreen SKIP, which lets administrators create encrypted point-to-point links between any two servers on the Internet. This is perfect for creating virtual remote offices.

Solaris for Intranets is impressive, but it does have some downsides. We would like to have seen greater integration among the various bundled products: Each has separate configuration procedures and uses separate databases to store user information. And after the initial WebStart installation, there were no obvious pointers for completing the configuration of any individual product.

INTEL OR SPARC HARDWARE?

We looked only at the SPARC version of Solaris 2.6, which runs on Sun SPARC hardware. The Intel-based version wasn't available in time for us to get our hands on it. Although Intel hardware is less expensive than SPARC hardware, going with the SPARC version of Solaris 2.6 does have some advantages. For example, third-party applications must be recompiled separately for each platform, and most Solaris applications run only on the SPARC platform. The hardware compatibility list for Solaris on Intel is growing, but you may find installing the Intel-based version difficult unless you have a standard hardware configuration.

THE FINAL ANALYSIS

The bundled products of Solaris for Intranets do a good job integrating Solaris servers in PC-based LAN environments. If Sun continues making Solaris easier to administer, it will continue winning over more and more Windows NT diehards.

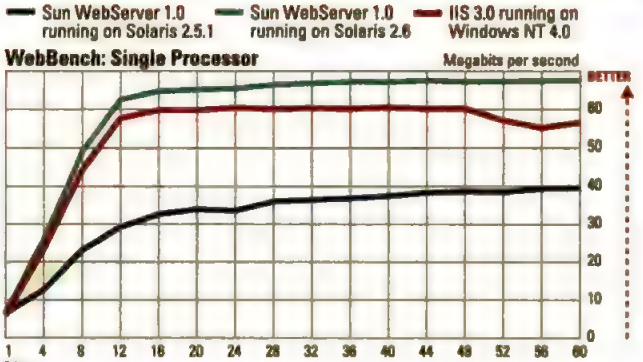
Solaris 2.6. List price: For five users, $695. Sun Microsystems Inc., Mountain View, CA; 800-786-7638; www.sun.com. *Circle 951 on reader service card.*

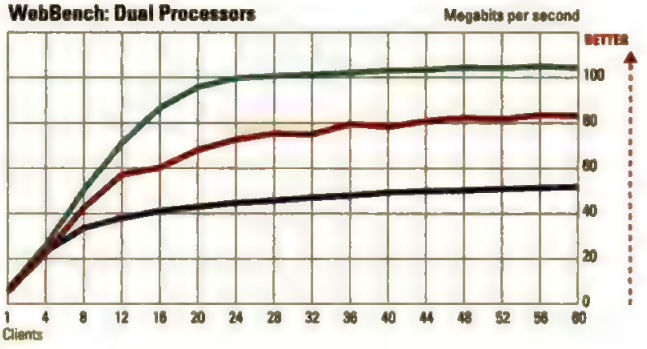
WHAT THE NUMBERS MEAN

Fast Web Services

In previous testing of Solaris-based Web servers on Solaris 2.5.1 ("Beyond Unix," *PC Magazine*, May 27, 1997), we noticed sluggish performance on our ZD WebBench 1.1 tests due to latency issues between Sun's TCP stack on the Web server and Microsoft's TCP stack on the clients. Our test results with Solaris 2.6 show that the problem has been solved.

On the performance test done at our sister publication's PC Week Lab, we tested Sun WebServer 1.0 (part of Solaris for Intranets) using the static HTML page test from ZD WebBench 1.1. On the client side, the test-bed consisted of 60 client machines with 32MB of RAM running Windows 95 connected to the network by Intel 100ProB Fast Ethernet network adapters. On the server side, we used an UltraSPARC Sun server with dual 300-MHz processors running Solaris 2.5.1 and then Solaris 2.6 to test Sun WebServer. We made four minor adjustments to our Web server—suggested by Sun—to increase server performance (for background, see "When 200 Milliseconds Matter," *PC Magazine*, September 9, 1997, page 29). To test IIS, we used a Dell PowerEdge 6100 server with 512MB of RAM and dual 200-MHz Pentium Pro processors running Windows NT 4.0.





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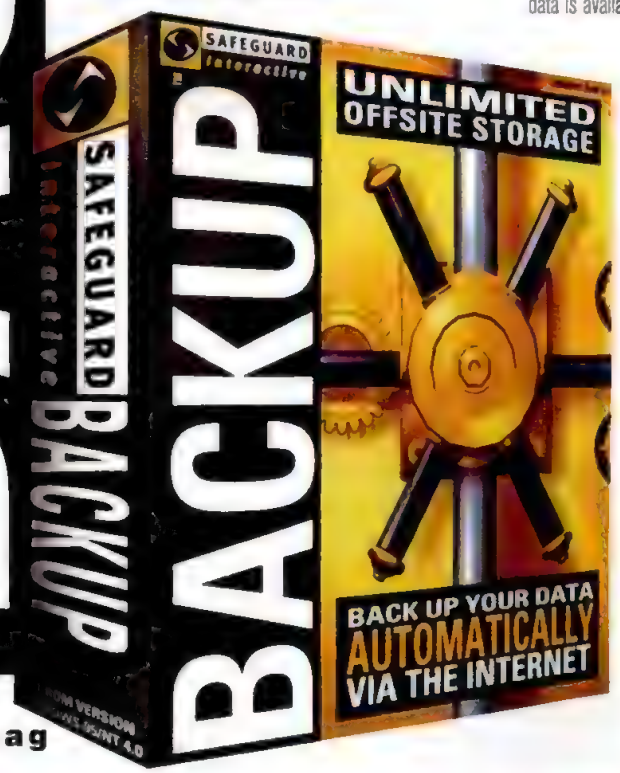

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Net Tools

INTERNET TOOLS

LAYER-3 SWITCHING

Is It a Switch or Is It a Router?

By Keith Turner

The popularity of the Internet and corporate intranets has created a dramatic shift in the flow of traffic across networks. Today, network traffic is constantly crossing subnet boundaries as users access remote applications and servers. Routers are becoming overloaded as they attempt to manage this increased subnet traffic. As a result, vendors are pushing layer-3 switching as a means to marry the intelligence of routers with the speed and economy of switches.

Layer 3 is shorthand for the network layer of the OSI (Open Systems Interconnection) reference model. At this layer, routers perform their functions based on address information used in network protocols such as IP and IPX. Switches operate at layer 2, the data-link layer, forwarding packets based on the physical addressing used by the network media. By adding some level of layer-3 knowledge to their products, switch vendors are creating what they call layer-3 switches.

At first glance, it looks as though every vendor is approaching this technology differently. But when you get down to the nuts and bolts of each implementation, three approaches to layer-3 switching have emerged: routing switches, flow switching, and switched routing.

ROUTING SWITCHES

A routing switch functions much like a conventional router, examining the layer-3 information in each packet to forward it along the appropriate path. The routing switch achieves lower cost and higher performance by reducing the number of supported functions and by moving as much of the logic into silicon as possible. In a true routing switch, route processing is tightly integrated into the switch so that packets do not need to leave the switching fabric during processing.

Routing switches will feel familiar to network administrators, as the switches behave much like traditional routers and support common routing protocols. Their feature sets must be examined closely, however, as some are often sacrificed for speed and cost. The features that are most commonly given up are support for non-IP protocols (such as AppleTalk and IPX), complex routing protocols (such as IP Multicast and OSPF), and security (such as encryption and firewalls).

Ascend, Bay Networks, Cisco, Extreme, Foundry, IBM, Intel, and Madge have all announced routing switch products. Each product offers a drop-in solution to off-load tasks from overworked routers in existing networks. In most cases, the switches can coexist with available equipment. Routing switches are primarily targeted at the campus, although at least one vendor's product, Ascend's GRF IP Switch, is targeted at ISPs and carrier services.

Vendors are also offering some innovations that will ease some of the administrative burden associated with managing routers in their routing switches. For example, the SwitchNode from Bay Networks can run in IP Autolearn mode, which allows the switch to learn the network topology by monitoring Address Resolution Protocol (ARP) traffic. ARP is used by network devices to map layer-3 to layer-2 addresses. So, in a simple topology, the SwitchNode can be dropped into the

Layer-3 Architectures Compared

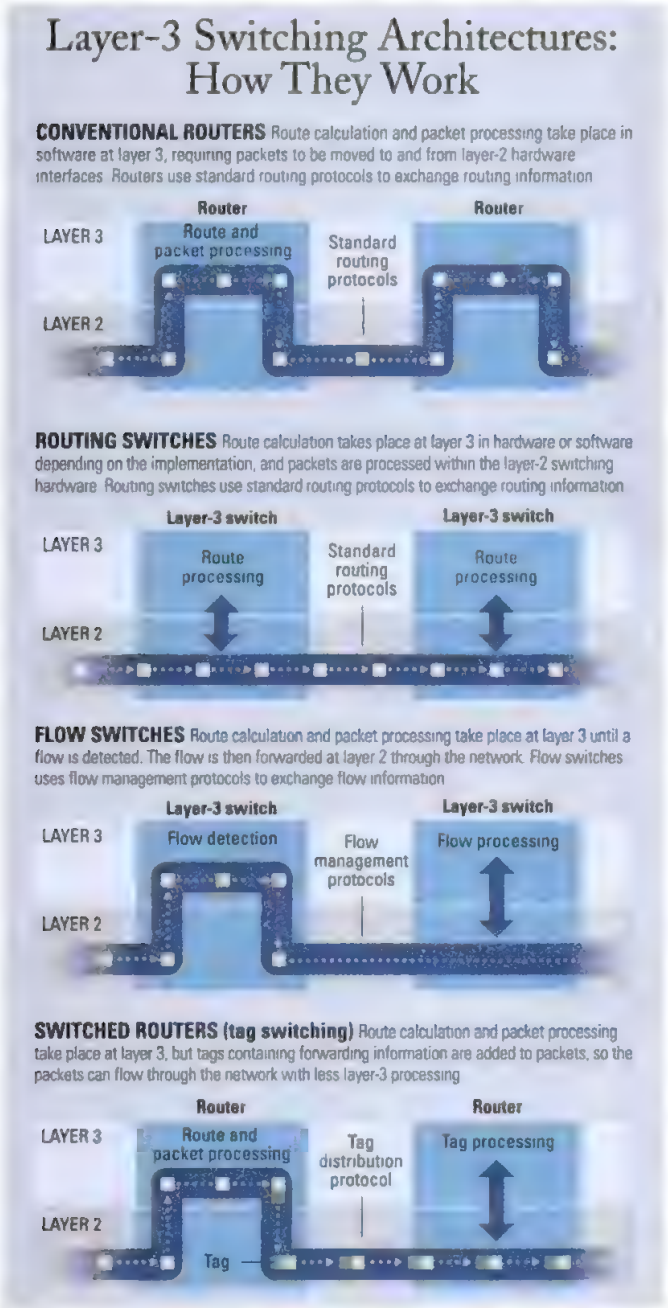
Architecture	Description	Advantages	Concerns	Best use
Routing switch	Traditional routing functions integrated into a switch.	Familiar functionality; interoperability with current network devices.	May lose some routing functions. Routing in hardware may make upgrading difficult.	Campus and ISP backbone.
Flow switching	Flows detected at layer 3 and switched at layer 2.	Removes routing complexity from the data path after flows are detected	Architecture is proprietary to certain vendors. Nonflow traffic is still routed	ISP backbone and WAN
Switched routing	Various schemes to reduce the need for layer-3 processing of packets	Scalable to large networks. Leverages existing routing hardware (tag switching). Reduces routing in the data path	Architecture is proprietary to certain vendors. Questionable interoperability.	Enterprise, ISP backbone, and WAN

network without configuring it to run a routing protocol and without modifying the setup of any existing routers.

FLOW SWITCHING

The basic concept behind flow switching is the identification of long-lived data flows between two IP nodes. When a flow is detected by layer-3 software, a switched connection is established between the endpoints, and the flow is then forwarded by hardware at layer 2. File transfers and Web graphics are examples of types of traffic that would be identified as flows. Traffic that does not meet the flow criteria is routed normally through the network. The flow-switching concept lends itself most naturally to ATM or frame-relay environments, where flows can be mapped to virtual circuits or paths. The target deployment for flow switching is the ISP or enterprise backbone.

The two key players in this arena are the ATM Forum and Ipsilon. The ATM Forum has recently ratified a standard for flow switching over ATM called Multiprotocol Over ATM (MPOA), but this standard was slow to develop. Ipsilon took advantage of the delayed release of MPOA and delivered its own form of flow switching called *IP switching*. Ipsilon has developed a line of IP switches that use the Ipsilon Flow Management Protocol (IFMP) to exchange flow information. Ipsilon is drumming up support for its platform and encouraging other vendors to support IFMP in their switching and routing devices.



SWITCHED ROUTING

The final approach and most difficult to nail down involves schemes to reduce the overhead of routing so that switches can perform layer-3 forwarding functions without the need for complex route calculations.

Cisco's Tag Switching architecture is a good example of switched routing. To implement tag switching, Cisco routers are software-upgraded to become either tag-edge routers or tag switches depending on their location in the network. A *tag-edge router* is a true router that sits on the network edge and adds addressing information, in the form of fixed-length identifiers called *tags*, to packets entering the network. A *tag switch* is a router or switch that sits on the interior network and uses the tags to determine the appropriate path through the network for each packet. The use of tags reduces the complexity of packet decoding and table lookups when forwarding packets. Cisco has also created the Tag Distribution Protocol (TDP) to allow tag routers and switches to distribute tag information. Cisco has submitted tag switching to the Internet Engineering Task Force (IETF) for standardization.

Flow switching lends itself to ATM or frame-relay environments, where flows can be mapped to virtual circuits.

IBM's Multiprotocol Switched Services (MSS) and 3Com's FastIP support schemes are based on route serving using the Next Hop Resolution Protocol (NHRP). Using NHRP, a network client requests a route from a designated route server. If the route server can locate the target, a switched connection is established between the endpoints. This effectively removes the router from the data path. In order to support NHRP on a networked PC, MSS requires additional software, and FastIP requires a 3Com network adapter on the PC.

Most switched routing schemes are being developed to address bottlenecks in complex IP networks like those of ISPs and carrier services. In an attempt to deliver switched routing to the entire enterprise, not just to ISPs or the WAN, Ascend, IBM, and 3Com have agreed to share layer-3 switching technologies.

THE MARKETPLACE

Layer-3 switching is still an emerging technology, and it's too early to tell whether one approach will receive better acceptance than another. Routing switches offer a familiar approach and the highest level of interoperability. Because these devices can be dropped into networks without a commitment to new standards or architectures, they may be adopted quickly. Flow switching and switched routing schemes currently rely on competing proprietary or emerging standards to boost packet-forwarding rates. This requires buyers to commit to a single vendor, and that could limit the appeal of flow switching and switched routing until standards emerge.

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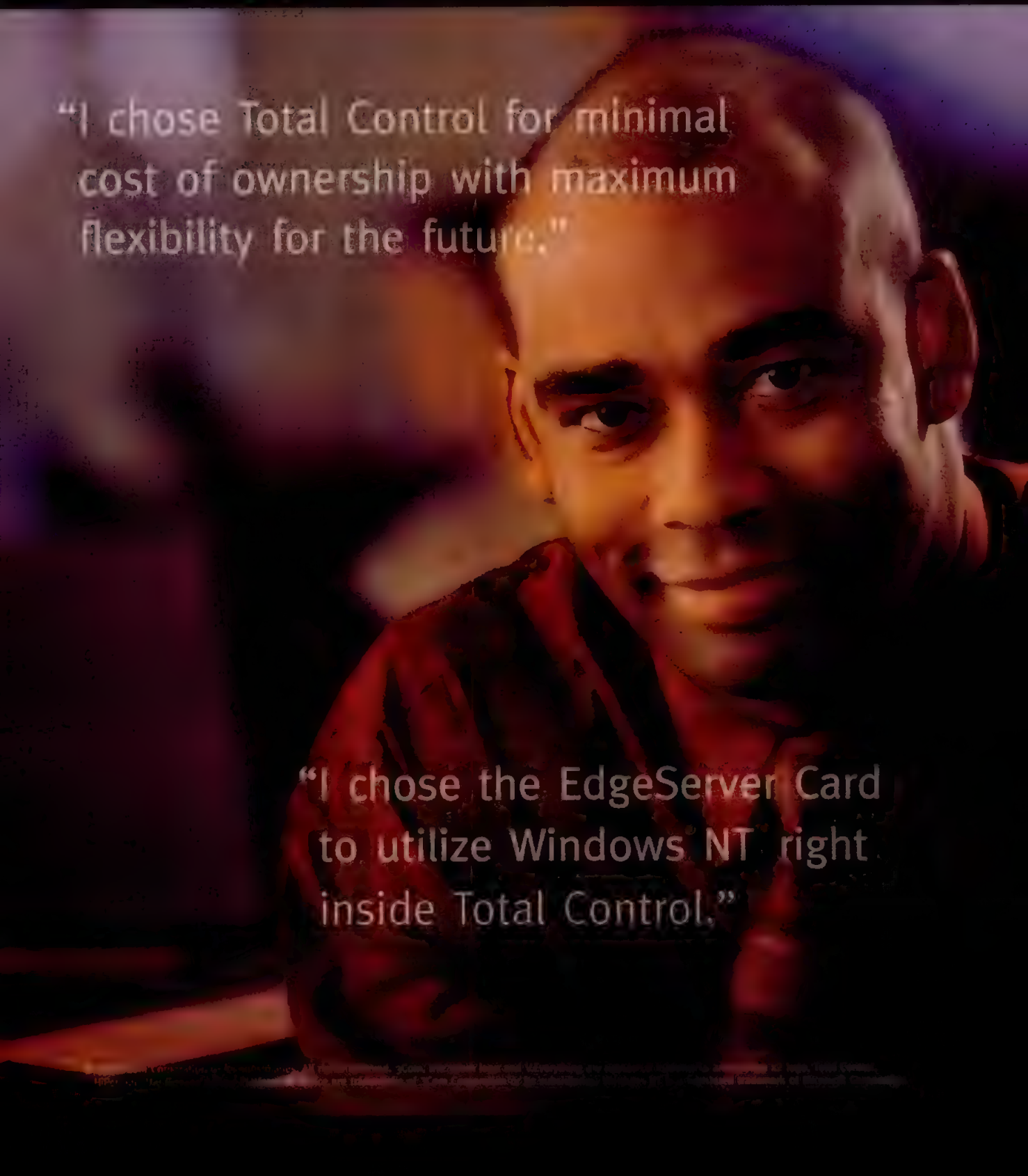

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PC Tech

Developing HTML Help

Emerging standards make HTML-based documents easier to navigate, view, distribute, and link to applications.

By Joe Welinske

The establishment of HTML as the de facto standard format for the majority of online documentation is no surprise to anyone working in or watching the software industry. Independent software vendors and corporate MIS departments are rushing to move printed documentation online and to convert existing online publications to HTML. You may already have contributed to the process by creating HTML pages for your company's Web site or intranet. The lure of HTML's cross-platform compatibility and the ability to update content dynamically and distribute it over networks has driven most of this effort. HTML is having the kind of profound effect on document publishing today that the laser printer did when it appeared on the scene more than a decade ago.

Unfortunately, current HTML standards are not equipped to handle the rigors of developing large-scale online publications. Effective online documentation requires capabilities that are not part of the broad HTML feature set, like standard navigational controls, custom window sizing and positioning, file compression and encapsulation, and a standard method for linking software applications to HTML pages. This need is now being met by Microsoft Corp., Netscape Communications Corp., Oracle Corp., and Sun Microsystems in a form known as *HTML-based help*. As the name implies, HTML-based help is primarily targeted at help documentation in support of software applications. However, it also has exciting potential for intranet and Web site documentation as well.

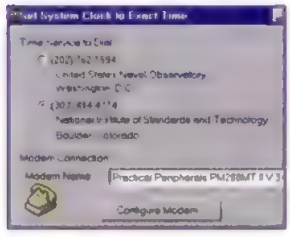
The most concerted effort in this area has come from Microsoft. Its HTML Help, which was released in August, provides a set of software components and file formats designed to optimize the presentation of HTML documentation.

ILLUSTRATION BY DENNIS HARMS

INSIDE

POWER PROGRAMMING: Windows CE is the newest 32-bit operating system from Microsoft. But it's more than an operating system, since it defines the specifications for hand-held PCs. *Page 285.*

▲INTERNET TECH: HTML 4.0 solves many of the problems of its predecessors. The new version boasts more design capabilities and extensibility and fewer proprietary codes. *Page 287.*



▲UTILITIES: ExactTime gives your PC's system clock the accuracy of an atomic clock. It calls up goverment services and automatically sets your system time. *Page 291.*

PC SOLUTIONS: Getting tables in WordPerfect 8 to span pages; finding the top several values in a range on an Excel spreadsheet; creating calculated fields in Access queries; and much more. *Page 295.*

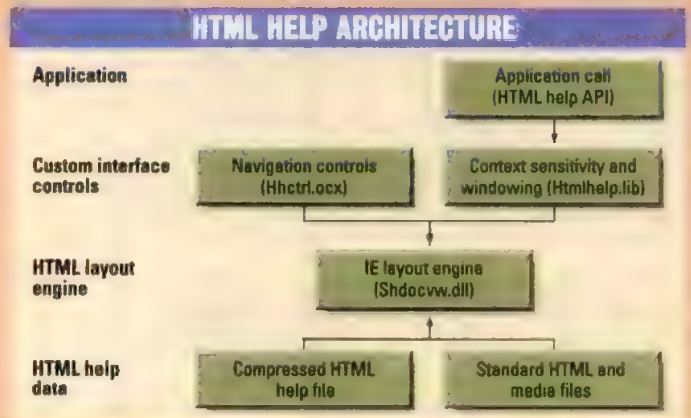
The HTML Help technology is closely integrated with Internet Explorer and uses DLLs and ActiveX controls (see the sidebar "HTML Help Architecture and Compatibility"). Microsoft's interest in this area is driven by the company's desire to reduce development costs and to build market share for Internet Explorer. With the entire organization focused on Internet compatibility, the online help for Microsoft's products is steadily migrating away from InfoView and the familiar WinHelp format to HTML Help.

To understand how HTML Help can work for you as a developer or as a user, you need only to reflect on your own Web or intranet experiences. How many times have you struggled to find your way through a maze of HTML pages? Among the problems HTML Help addresses are the following:

- Jump links or image maps may work well enough in a small Web site, but they fail miserably when used in larger sites that contain hundreds of HTML pages. The problem is exacerbated by the plethora of navigational designs among sites. HTML Help offers a standard file format that makes it easy for developers to create navigation controls and for users to work with those controls. The table of contents, index, and full-text search controls appear in what Microsoft calls a "tri-pane"

HTML Help Architecture and Compatibility

Microsoft's HTML Help relies on a lot of proprietary technology, the biggest chunk being Internet Explorer. When you launch an HTML Help system, the files are processed by Internet Explorer's layout engine, Shdocvw.dll. Regardless of whether the HTML Help is displayed in a browser, the tri-pane window, or an application, the layout engine is working behind the scenes. Navigational controls, window support, and linking to applications all rely on the layout engine, as is shown in the diagram.



The bottom line is that Internet Explorer needs to be installed on a user's computer for HTML Help to work. That's a tough requirement for many developers. As Internet Explorer's market share increases and users upgrade to Windows 98, however, the decision to use HTML Help will become much easier for developers.

Another thorny issue is cross-platform support—or rather, the lack of it. Many of HTML Help's components are not available for Windows 3.1, Macintosh, or Unix. Since a big part of HTML's allure is that it is meant to be a platform-independent solution, that's a big stumbling block. To solve part of that problem, Microsoft provides a Java applet for displaying your table of contents and index. However, Microsoft's fix limits the amount of customization you can make to those navigational controls and doesn't provide window control or context sensitivity.

WINHELP OR HTML HELP?

If you have already developed help files with WinHelp or are in the process of doing so, don't panic. Microsoft has indicated that Windows will continue to support the format. In fact, it is likely that WinHelp will continue to be the dominant form of online help for quite awhile. WinHelp is easier, provides a better user interface, and is much faster than the still evolving HTML Help. Make sure you have compelling reasons to move to HTML Help and that your users have the installed components necessary to display your work.

Once you've made the decision to move from WinHelp to HTML Help, you can use the conversion utility available in HTML Help Workshop. The utility converts your topics from your .rtf file into separate HTML files. If you have used the WinHelp 4 contents file, it is automatically converted into an .hhc file. Index entries from your K footnotes are converted into an .hhk file. Unfortunately, you lose features like pop-ups (they are turned into jumps) and browse sequences, which are not supported in HTML Help.

ALTERNATIVE HELP SOLUTIONS

The fact that Microsoft's HTML Help is primarily a Windows-centric solution doesn't sit well with developers who expect HTML solutions to be cross-platform. The Help Technology Update Conference, held in Cambridge, Massachusetts, in late September, was the stage for demonstrations of offerings from Netscape Communications Corp., Sun Microsystems, and Oracle Corp. These systems all have cross-platform development as their primary focus.

- **Netscape's NetHelp** A version of HTML-based help has been available from Netscape (*home.netscape.com/eng/help/home*) since the summer of 1996. Netscape's system, called NetHelp, offers single-source development that can be used on any of the many platforms supported by Netscape Navigator. The recently released Version 2 provides navigational controls, custom sizing of the Help window, and context-sensitive linking of an application and HTML files.

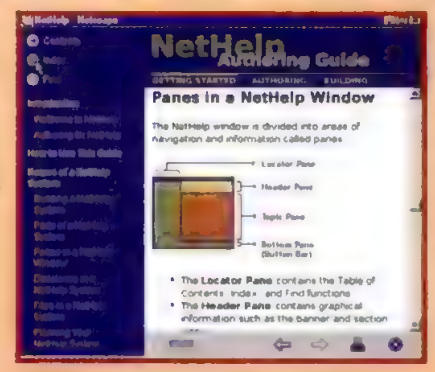


FIGURE A: *A sample topic displayed in NetHelp, Version 2.*

No special files beyond Navigator need to be installed on the user's computer to enable a NetHelp system. However, NetHelp's practical application is highly constrained by the requirement that Navi-

window, as shown in Figure 1. The navigational controls are docked to the content and can be hidden or exposed with a click in the button bar.

• Distribution size has become critical as we have become increasingly dependent on delivering content over networks. Standard HTML's file format is inefficient, however. HTML Help compiles HTML files to a fraction of their original size.

• Managing HTML documentation can be a nightmare when you have to deal with hundreds of separate HTML and graphic files. HTML Help is attempting to solve this by encapsulating your source files into a single file addressable by a single URL.

• HTML Help also makes it possible to customize the window in which you display your content and to call HTML pages from within software applications.

HTML Help is an emerging technology, but you can begin experimenting with it today. The next part of this article will lead you through the development of a typical HTML Help project.

BUILDING AN HTML HELP SYSTEM

The development process for an HTML Help information system is the same whether you are a seasoned expert in HTML or a newcomer.

gator be resident on the user's computer. Unless you are willing to ship and install the browser along with your help system, NetHelp is useful only in intranets that have standardized on Netscape products. Because of this, independent software vendors are not likely to use NetHelp.

A software development kit (SDK) is available free from the Netscape Web site. The centerpiece of the SDK is a project-building tool, NetHelp Builder, which generates the table of contents, index, and user interface frameset. The kit also includes an HTML-based NetHelp authoring guide and a template for customizing the user interface.

The standard NetHelp window has navigational controls arranged along the left and top with the help content displayed in the right center, as shown in the screenshot in Figure A. The lower pane of the frameset contains *Back*, *Forward*, *Print*, and *Exit* buttons. Although the navigational controls have improved since the first version of NetHelp, they are distinctly inferior in performance to the Microsoft equivalents.

• Sun's JavaHelp

The growing popularity of Java as a platform-independent programming language has prompted Sun's JavaSoft division to begin development of a specification for JavaHelp, a standard for attaching HTML-based help to Java applications, applets, and components (JavaBeans). JavaHelp will provide navigational controls and an application programming interface. Navigational controls will consist of Java applets for an expanding and collapsing table of contents and an index similar to Microsoft's. Navigation will also include support for full-text search. For encapsulation and compression, JavaHelp will rely on the existing Java Archive (JAR) format, which acts like a .zip file.

The help content and navigational controls will be displayed in a standard window, as shown in Figure B. The API is likely to have support for customization of the standard window, with both Motif (Unix) and Win32 look and feel. Help authors will also be able to use JavaHelp for standalone documentation that is not attached to a Java application.

The projected release schedule is to have JavaHelp classes available in early 1998. At that time, Java licensees will begin adding an updated virtual machine (VM) to their browsers and applications. JavaHelp will work on any platform supporting Java, which today includes HP-UX, Mac OS, SGI, and Solaris, in addition to Windows 95 and NT.

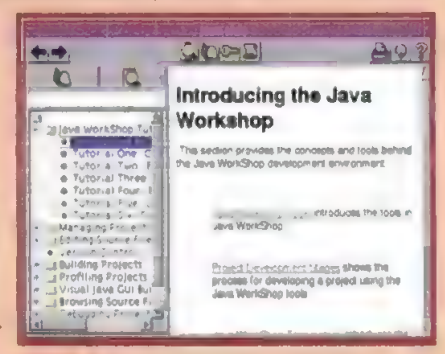


FIGURE B: *The user interface of Sun's JavaHelp.*

• Oracle Sun isn't the only company interested in capitalizing on the cross-platform nature of Java. Oracle is working on its own implementation of HTML-based help for Java applications. The technology is used currently in the Java versions of the company's Enterprise Manager, Video Server Manager and Oracle8 Assistants. It is also being integrated into Oracle's Developer/2000, to allow developers to add help support to their Web applications.

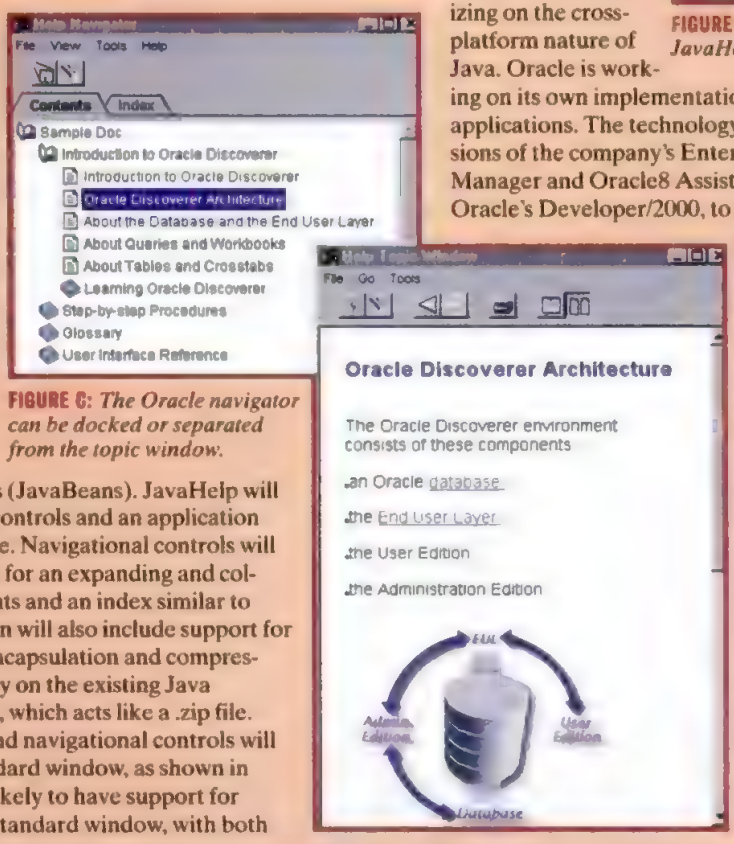


FIGURE C: *The Oracle navigator can be docked or separated from the topic window.*

Oracle's system uses navigational controls and a browser window to display HTML files. The navigator window provides tabbed access to a table of contents and an index, which use Microsoft's Sitemap format. Users can click a control in the button bar to dock the navigator to the topic window or to disconnect the two, as shown in Figure C. Other features include full-text search and an API for displaying help from Java applications. Oracle's API supports custom window sizes and positions, and multiple topic windows can be shown at the same time. When Oracle's system is released, it will be available for download through the company's Web site.

You always start by creating your content; then you assemble your navigational controls and design your user interface. Finally, you compile and distribute your publication. Before any of that, however, you'll need to download HTML Help from Microsoft. You will also need Internet Explorer 3.02 or higher. In addition to installing the components that enable HTML Help, the setup program provides you with HTML Help Workshop, an authoring tool that assists you in creating content, navigational controls, and user interfaces. It also compiles your files for distribution. You can find information on alternative authoring tools in the list of online resources at the end of this article.

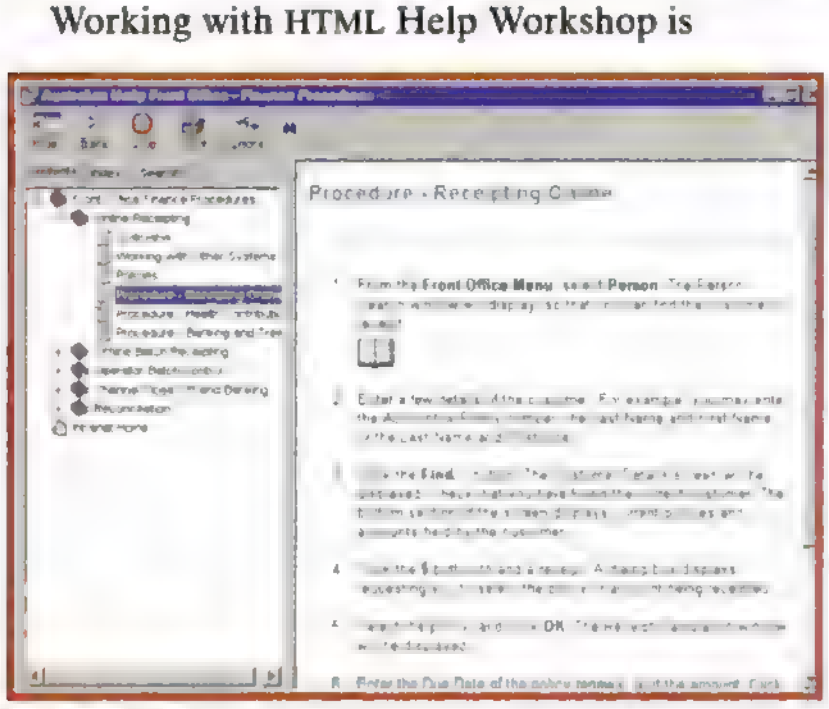


FIGURE 1: *Microsoft's HTML Help is displayed in the tri-pane window.*

Working with HTML Help Workshop is straightforward. Authoring controls are located on the left, and your HTML files appear in an editor on the right, as you can see in Figure 2. Your first step is to start a new project in Workshop. A wizard guides you through the steps. The project file becomes the command center for your entire HTML Help system.

CREATE YOUR CONTENT

Content is what brings users to your HTML documents, and that is the area on which you will spend most of your time. The nature of your content should drive the rest of your help-system design. In HTML Help, content is created in a text editor with HTML tags or by the use of an HTML authoring tool. HTML Help Workshop provides a simple text editor. Alternatively, you could use another authoring tool to create your content files and then include those files in the project in Workshop. Clicking the name of an HTML file in the left pane of Workshop displays the HTML source in the right pane as shown in Figure 2. You can also view the HTML file in a WYSIWYG window.

From a design perspective, one of the most difficult decisions to make regarding HTML content has been whether to save topics as separate files or combine multiple topics into a single file and link to them with named targets. The former method delivers information to a user faster, since file size stays relatively small. But if you have hundreds (or thousands) of topics, file management can become extremely tedious. With HTML Help Workshop, you can choose to author multiple topics in a single file and have the topics split into separate HTML files during compiling.

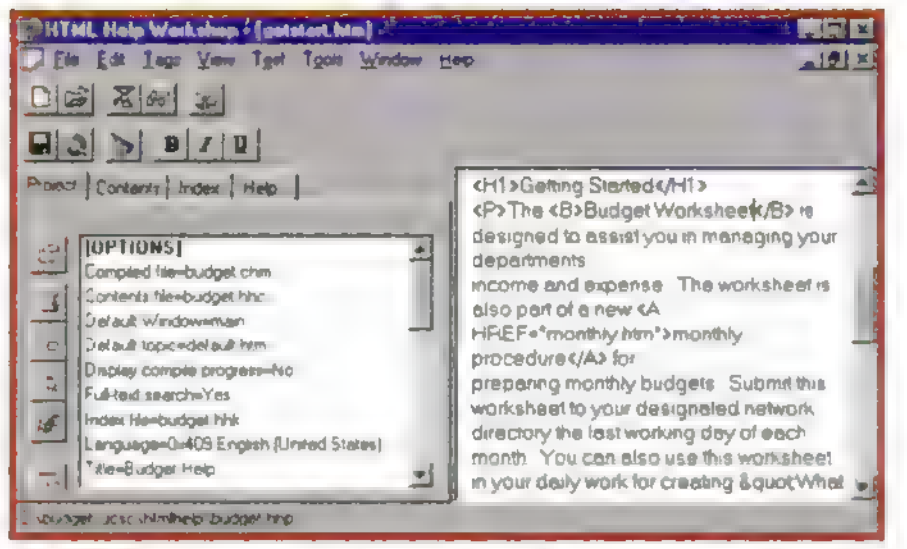


FIGURE 2: *A project in HTML Help Workshop.*

ADD NAVIGATION CONTROLS

Once you have your content in one or more HTML files, you need to create ways for users to access it. HTML Help supports a table of contents, an index, and full-text search. The table of contents is for users who are not familiar with the structure of your site or with the nature of the content. It provides a general overview, often resembling an outline of your content, to lead users to appropriate topics.

If you were using standard HTML, you would need to create jump links to your various pages. This navigational method is difficult to implement effectively, as it offers many opportunities for error and is extremely difficult to maintain. With HTML Help, a user sees the table of contents as an expanding and contracting hierarchy of topic entries and folders. Topic entries display a particular HTML page, and folders reveal other topic entries and subfolders, in a manner similar to the *Contents* tab in WinHelp.

You create the hierarchy in HTML Help Workshop, which provides a fully expanded view of your table of contents as you build it (Figure 3). For each topic entry you specify the URL of the page you want to link to. When you are finished adding folders and links to URLs, you save the table of contents as a text file with the extension .hhc. You can also use custom icons and change the background color and the foreground text color.

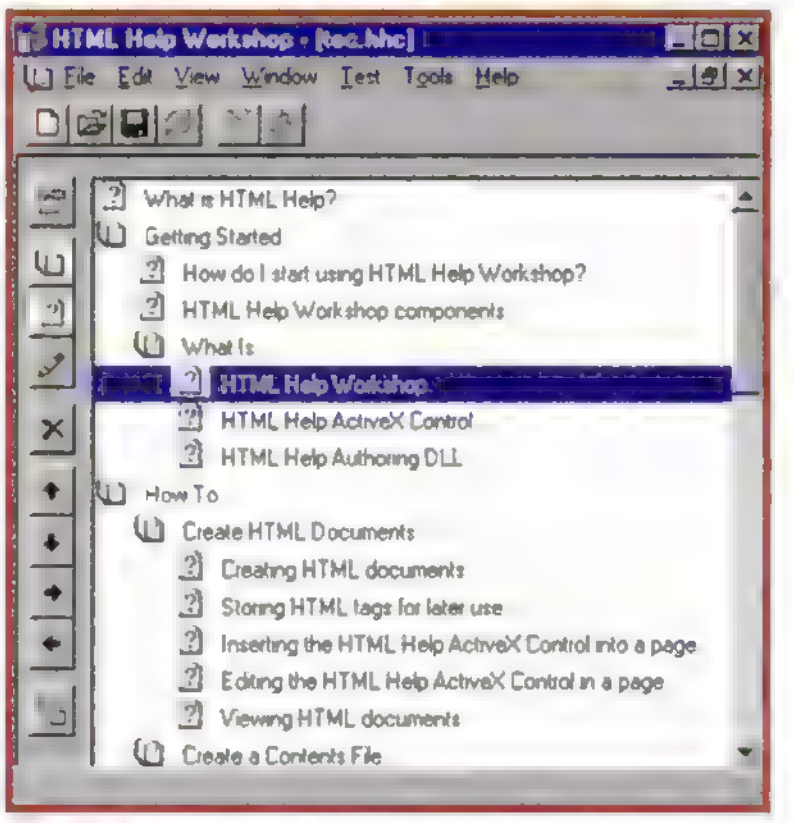


FIGURE 3: *A contents file displayed in HTML Help Workshop.*

If you view the table of contents file in a text editor, you'll see that it resembles an HTML unordered list. What you are looking at is called the Sitemap, a file format developed by Microsoft to display hierarchical lists of links. HTML Help uses the Sitemap for the table of contents and the index. Microsoft has submitted the Sitemap technology to the World Wide Web Consortium (W3C) for inclusion in the XML WebCollections specification. Sitemap files are interpreted by either an ActiveX control or a Java applet.

Where the table of contents provides users with general access to help topics, the index offers an experienced or knowledgeable user very quick access to specific topics. The creation of an index is not easily automated, which is why most Web or intranet sites don't use them. An effective index must anticipate what words your users are likely to have in their heads and be able to display that word list to them. WinHelp has always provided these capabilities, and they have been carried over into HTML Help. When a user clicks the *Index* tab, a list of entries appears, as shown in Figure 4.

The index is constructed in a manner similar to creating the table of contents. Using Workshop, you make index entries and associate them with URLs. You can associate one entry with multiple URLs, if the entry applies to more than one topic. When you save the index file, Workshop gives it the extension .hhk. In a future release, Workshop will gen-

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erate the index automatically from keyword tags you'll embed in your HTML files.

No HTML publication would be complete without a full-text search (FTS), and HTML Help is no exception. To implement it, you simply make a selection in your project file in Workshop, and Workshop automatically generates a full-text search index file during compiling. To find a word or phrase, a user clicks the *Search* tab and types in the search text. HTML Help returns a list of pages containing the search string. The user can then select one of the pages listed to display the page's contents in the right pane, as shown in Figure 5.

Full-text search is widely used in the Web world, yet many people have difficulty constructing effective search strategies. It is very common for a full-text search to return more hits than a user knows what to do with. On top of that, HTML Help's full-text search finds only words used in the publication being searched. Synonyms or acronyms will not be found unless they are in the text. FTS should therefore be considered a supplement to the index rather than a replacement. One concern about FTS with regard to distribution is that its index file can be quite large. Also, HTML Help's full-text search does not support Boolean operators, unlike most Web-based search engines.

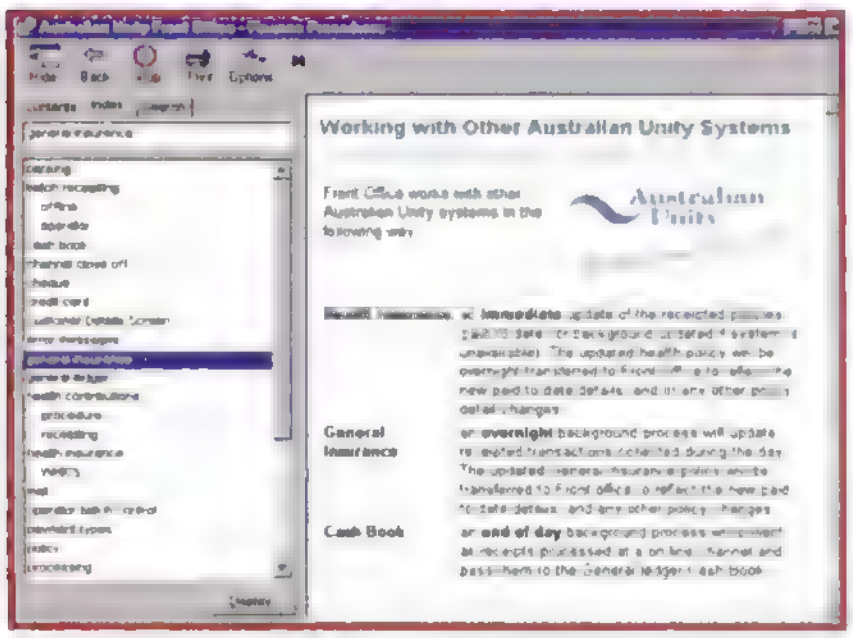

FIGURE 4: *Using the Index to locate a topic.*

CUSTOMIZE YOUR DISPLAY WINDOWS

The default display window for HTML Help is the tri-pane window, but you can customize the size and position of the Help window to make it easier for users to work with your content. This capability may be especially important if the point of your content is to assist a user with a software application—you could, for example, display a procedure topic in a short, narrow window positioned in a corner of the screen, possibly excluding the button bar, as shown in Figure 6. You can create more than one window type, and you can have more than one window open at the same time. In addition to a window for procedures, you might use a larger one to display longer conceptual topics, tables, or images. This offers the potential for interesting new document designs that aren't possible with standard HTML. All of the customization control for window types is provided in HTML Help Workshop.

COMPILE AND DISTRIBUTE THE HELP SYSTEM

Once you have assembled your content and navigational controls and specified one or more window types, you are ready to compile and distribute your project. The compiling process first encapsulates all the HTML, image, .hhk, and .hhc files associated with your project into a single file, which is given a .chm extension and which can be used in the address bar of Internet Explorer or called from an application.

The .chm file is compressed to a fraction of the size of the original source files. A set of source files that total a megabyte might be compiled into a .chm file of only 50K. This significantly reduces the amount of space the help system takes up on a local computer and dramatically reduces the time required to download it. Users will not notice any reduction in performance; the HTML topic files appear just as fast as if they were uncompressed.

You start the compiling process by clicking the *Compile* button in HTML Help Workshop. A series of messages appears in the right pane, marking your progress. When compiling is complete, you are presented with a single URL, which has the .chm extension. You can view this file in HTML Help Workshop, access it from the address bar of Internet Explorer, or call it from an application. You can also create links between topics in different compiled help files by using a modified reference tag:

```
<a href="help.chm:/topic.htm">
```

While the compressed file format has enormous potential, it is proprietary Microsoft technology that requires a special URL format, and it works only with Internet Explorer.

OTHER HTML HELP FEATURES

HTML Help offers a number of other features that can make your documents more powerful. These include user interface customization, links to applications, and information types.

If you are developing intranet or Web documentation, you might prefer using something other than the standard tri-pane window. You can still add the HTML Help navigational controls to your own pages and use the compressed file format. You do, however, lose the ability to customize the display window. The first step is to create Sitemap file containing a table of contents, as described earlier. Next, determine which HTML file you want the table of contents to appear in. Finally, use the HTML Help Workshop ActiveX wizard to add the table of contents control to your HTML file.

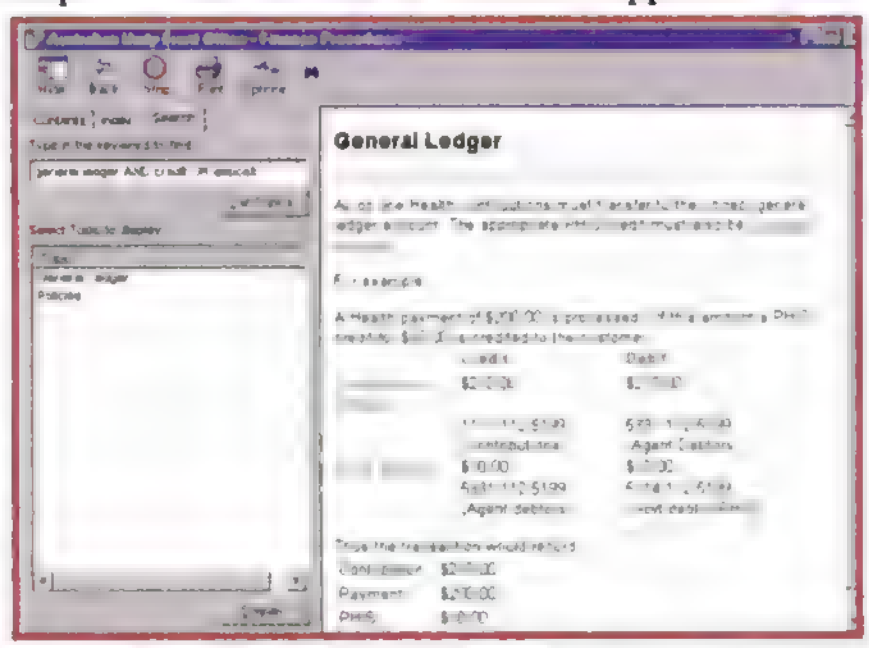

FIGURE 5: *Using full-text search to locate a topic.*

In the example in Figure 7, you have a frameset file, Notpad.htm, which defines two frames. The left frame displays the table of contents, and the right displays topics selected from the table of contents. The default HTML file in the left frame is Toc.htm. The table of contents ActiveX object is added to this file using the HTML Help Workshop wizard. The code specifies which .hhc contents file to use, in this case Toc.hhc:

```
<OBJECT id=hhctrl type=
"application/x-oleobject"
      classid="clsid:adb880a6-d8ff-
      11cf-9377-00aa003b7a11"
      codebase="hhctrl.ocx"
      width=100
      height=100
>
<PARAM name="Command" value=
"Contents">
<PARAM name="Item1" value=
"c:/project/toc.hhc">
</OBJECT>
```

Alternatively, you could have an index in the left frame by using an HTML page that contains the index ActiveX object.

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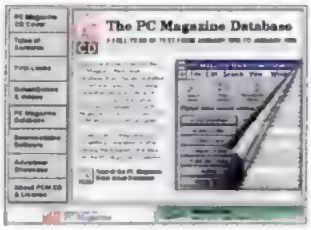

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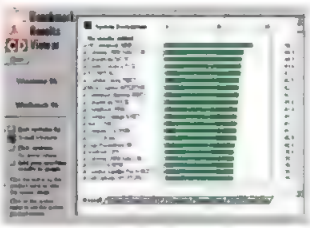

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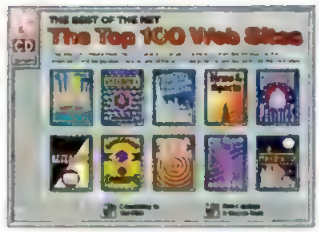

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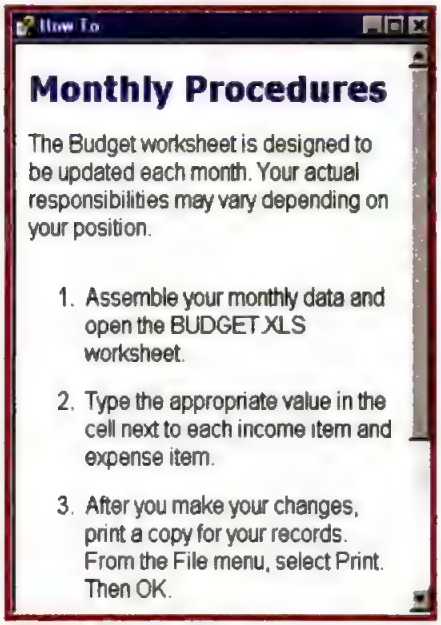

FIGURE 6: *HTML Help in a secondary window, without a button bar.*

to deliver help topics to users is via a *Help* button or menu. The HTML Help Applications Programming Interface (API) provides a standard format for doing just that. Besides calling a topic, the API also can define window styles, coordinates, caption, and display state. The API is documented in the reference material provided with HTML Help Workshop.

One of the most frequent problems encountered in putting together online documentation is how to satisfy the needs of a variety of readers. No matter what type of content you have, your audience will almost certainly represent widely varying levels of experience and learning styles and different areas of interest. An innovative feature in HTML Help called *information types* is a possible solution. Information types let users filter the entries that will appear in the table of contents and index by selecting characteristics you have assigned to the various topics. For example, you could separate introductory and advanced information, or information for end users and information for system administrators. In a modular application, such as an accounting system, a user could choose among functional areas: General Ledger, Accounts Receivable, and so forth. For documentation translated into multiple languages, you let readers select which they prefer. The potential uses for information types is wide-ranging.

Information types are part of the Microsoft Sitemap format. You can use HTML Help Workshop to define your types and assign them to the appropriate topics. Users can control the information types from within the HTML Help system.

AUTHORING TOOLS

For a number of years, WinHelp developers have enjoyed numerous authoring tools specifically targeted to their needs. Tool vendors are now coming out with products supporting the various HTML Help standards. For the most part, the various tools can all get you to the same result. But they couldn't be more different in their interfaces, and it's a good idea to try out the products you're interested in before you make your final decision. While Microsoft's HTML Help Workshop is certainly a suitable tool at a great price (it's free), I think you will find that the tools listed here quickly pay for themselves through improved efficiency, error prevention, and learning curve reduction.

- Doc-To-Help, WexTech Systems, New York, NY; 800-939-8324, 212-949-9595; *www.wextech.com.*
- eAuthor/Site, HyperAct Inc., West Des Moines, IA; 515-987-2906; *www.hyperact.com.*
- ForeHTML, ForeFront Inc., Boulder, CO; 800-357-8507, 303-499-9181; *www.ff.com.*
- HelpBreeze HTML Wizard, Solutionsoft, Sunnyvale, CA; 408-736-1431; *www.solutionsoft.com.*
- HTML Help Workshop, Microsoft Corp., Redmond, WA; *www.microsoft.com/workshop/author/htmlhelp.*
- RoboHTML, Blue Sky Software, La Jolla, CA; 800-459-2356, *www.blue-sky.com.*
- Hypertext Development Kit, Virtual Media Technology, North Sydney, Australia; *www.virtualmedia.com.au.*

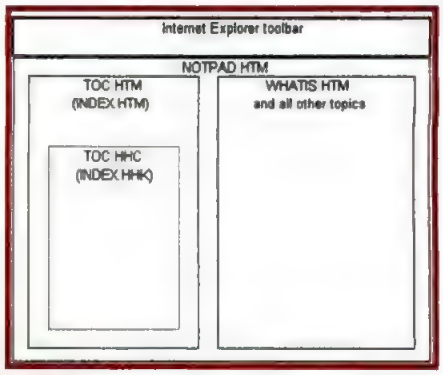

FIGURE 7: *A sample frameset blueprint for an HTML Help design.*

Joe Welinske is the author of Developing Online Help for Windows 95 *and the publisher of* The Online Help Journal. *He can be reached at* jw@winwriters.com.

Windows CE: The New Little Guy in Town

The latest Microsoft OS optimizes Win32 for handheld computers.

By Douglas Boling

Just when you think you have mastered the two 32-bit Windows operating systems—Windows 95 and Windows NT—Microsoft has added a third. Windows CE is the newest and arguably the most interesting of Microsoft's operating systems. Like its bigger cousins, Windows CE's shell has the Explorer look and feel. Scaled-down versions of Microsoft's flagship applications, Excel and Word, are available for the lilliputian OS. And also like Windows 95 and NT, Windows CE uses a variant of the Win32 application programming interface.

What makes Windows CE interesting lies partly in its size, partly in its flexibility, and partly in its target market. If the design goal of Windows 95 was backward compatibility, and if the goal of Windows NT is to be the best enterprise OS, the goal of Windows CE is to provide a modern, multithreaded, cross-platform OS in a small package. Although Windows CE is not as tiny as U.S. Robotics' Palm Pilot OS, it is much smaller than Windows 95 and NT, which require tens and hundreds of megabytes of storage, respectively.

Windows CE was developed over the last few years under the code name Pegasus. The Pegasus project was not limited to the design and production of an operating system but included the detailed specification of a new device, which was later dubbed the handheld PC (HPC). About the size of a Sharp Wizard, the HPC is to be the first of many platforms to use Windows CE.

THE HANDHELD PC

An HPC includes a small 480-by-240 or 640-by-240 gray-scale display, accompanied by a small Chiclets-style keyboard in a clamshell case. Instead of a mouse or touchpad, the device has a touch panel covering the screen. Every HPC includes a serial port and 115-Kbps infrared port. Systems have either a PCMCIA slot or, in the case of the Phillips Velo, a minicard slot.

The HPC's memory configuration is interesting. A typical HPC has 4MB to 8MB of ROM and 2MB or 4MB of RAM. The ROM contains the operating system and the accompanying pocket suite of office applications. Since the files in ROM are executed in place, the ROM-based applications take up little valuable RAM while running. Of course, there is a fair amount of RAM overhead for the operating system—around 500K—but the applications themselves are quite miserly. For example, the word processor bundled with the HPC, dubbed Pocket Word, uses only 16K of RAM when it is loaded.

The RAM is divided into two parts, one for system RAM used by the operating system and applications and the other, the *object store*, for data storage. Files in the object store are compressed, with an average ratio of 2:1. HPCs have neither floppy nor hard disks, although SRAM and ATA flash PC Cards are supported on devices with PC Card slots.

Completely breaking with Microsoft tradition, HPCs do not use Intel or Intel-compatible microprocessors. Instead, the HPCs currently shipping use one of three RISC CPUs: the Hitachi SH3, the MIPS-compatible NEC VR4101, or the MIPS-compatible Phillips 3910. Since the NEC and the Phillips CPUs employ a common subset of the MIPS op code set, from a software point of view really only two types of CPUs are currently used, MIPS and SH3.

FIGURE 1: *The display of our very bare-bones Windows CE example program.*

Bundled with each HPC are miniature versions of Microsoft's office applications—Pocket versions of Excel and Word, a task list and calendar, Internet Explorer, a POP3 mail client, and the obligatory Solitaire. Pocket Word does very basic word processing with minimal support for fonts and lists. Most of the features that a Word adept would expect—such as style sheets, tables, and even spell-checking—are not supported. Pocket Excel is also a shadow of its bigger PC-based cousin. The mail client may be the most complete of the pocket applications, although it too has a major limitation, in that it does not support attachments. The pocket suite does provide a minimal set of functionality that fulfills nicely the goals of the HPC. Face it—nobody is going to write *War and Peace* on an HPC's tiny keyboard.

Every HPC comes with a communication and synchronization application that runs on a PC, which communicates with an attached HPC through a serial port. The program, called HPC Explorer, looks like Windows Explorer but displays only the files on the HPC. When you drag a file from Windows Explorer to HPC Explorer, a file filter translates it from the PC format to its equivalent HPC format. Pocket Excel, Pocket Word, and the scheduler have more compact document file formats than their PC equivalents.

Programming for the HPC is simple. Anyone with experience developing C programs for the Win32 API can be developing HPC applications in no time. The requirements are Visual C++ 5.0, Visual C++ for Windows CE (an add-on that supports new target platforms for the MIPS and SH3 CPUs), a new wizard for the HPC version of the Microsoft Foundation Classes, and a number of tools for remote debugging on the HPC.

THE WINDOWS CE API

Writing a program for the HPC is just like writing a program for Windows NT or Windows 95, with the not-so-minor difference that much of the Win32 API is not supported under Windows CE. The current version of Win32 for Windows CE has only around 500 calls, whereas the version for Windows 95 or NT has approximately 2,000. That's not as bad as it sounds, though, since a number of the Win32 functions are redundant, a result of the long legacy of backward compatibility with previous versions of Windows.

Aside from these superfluous calls, entire groups of Win32 API calls are missing. For example, the current version of Windows CE doesn't support printing. Also unsupported are COM objects and therefore OLE and ActiveX controls. Microsoft plans to add some support for ActiveX in future versions of Windows CE.

Because it doesn't support COM, Windows CE uses its own interface for dealing with the desktop shell. Creating shortcuts and working with the *Recent Documents* menu item are simple matters of function calls rather than complex COM projects.

The Windows CE API provides some functions that are not supported under Windows 95 or NT. Windows CE has an extensive set of communications functions to facilitate communication between HPC and PC. A set of notification functions enables Windows CE programs to notify a user at a specific time or to run programs at set times or after predefined events, such as docking.

The miniature version of MFC for Windows CE should be used only with great caution. The HPC devices that run Windows CE are short on CPU power and on memory. Like their PC counterparts, MFC applications for Windows CE require a DLL to be loaded, and this DLL is larger than 400K. That's not a lot of memory on a PC, but the DLL hits an HPC's memory capacity twice. First, the DLL must be stored in the object store RAM, taking up around 250K as compressed by the object store. Then, when an MFC application is loaded, the DLL must also be loaded, this time taking up its full 400K. On a system that may have only 700K of free system RAM, the MFC DLL is a huge hit. Of course, if the MFC DLL is stored in ROM, it executes from there, using no object store RAM and much less system RAM. Unfortunately, only one HPC I know of does this—the high-end HP 320, from Hewlett-Packard Co.

The second problem with MFC applications is that they are noticeably slower on HPCs. The MIPS and SH3 CPUs may be close to low-end Intel CPUs in raw horsepower, but they lack the high-speed external caches that make other RISC machines race. The constraints are in the cost, the low power requirements, and especially the size of the HPCs. There is no room for cache RAM, even if you ignore the cost and power factors. So MFC applications, with their larger footprints and high overhead, do not perform at a speed most users would expect given the raw horsepower specifications of the different CPUs.

AN EXAMPLE WINDOWS CE APPLICATION

The best way to demonstrate that writing for Windows CE is like writing for any other Windows platform is to provide an example application. Figure 1 shows the display of a very basic "hello Windows" application, and its source program is available for downloading from PC Magazine Online. (See the sidebar "Getting the Files" for instructions.) The application contains the standard `RegisterClass` and `CreateWindow` calls. The main window procedure looks like any other Windows window procedure. But there are a number of subtle and not so subtle differences we should review.

First, a Windows CE application running on an HPC typically runs as a full-screen window, in order to make the most of the small HPC screen. HPC application windows typically don't have title bars or sizing borders, since windows can't be sized. Most Windows CE windows don't have these accoutrements, and

> MFC applications, with their larger footprints and high overhead, do not perform at expected speed on Windows CE machines.

that's one reason Windows CE does not support NC_*xxx* messages.

Also, there is no cursor support, other than a wait cursor to indicate that the system is busy. Because of this, the default cursor field in the `WNDCLASS` structure used when registering window classes is not supported and should be set to `NULL`. Likewise, the `Icon` field in the `WNDCLASS` structure is not supported. Instead, a 16-by 16-pixel icon should be set manually after a window is created. This icon is class-specific, rather than window-specific, so all windows of a class will have the same icon.

Instead of a menu, Windows CE applications have a command bar—a combination menu and toolbar. This saves even more screen space, since the menu and buttons for the toolbar are on the same line in the screen, instead of one under the other as is the case with PC applications.

Working with the command bar involves a new set of functions that a Windows CE application must call. Instead of setting a menu in the `WNDCLASS` structure, you must create a command bar and assign menus to it. The application shown in Figure 1 creates the command bar when it processes the WM_CREATE message. For this simple application, no menu is added to the command bar, since none is needed. The function `Commandbar_AddAdornments` adds a close button to the upper-right corner of the window.

Painting the client window is identical to painting in any Windows application, with the exception that you need to take the command bar into account. One quirk of the command bar is that it sits in the client area, so its height must be subtracted from any `GetClientRect` calls to determine the true paintable area of the client window.

To help accommodate the low-memory environment in which Windows CE applications run, Microsoft has added a new message, WM_HIBERNATE. Windows CE sends a WM_HIBERNATE message to a window when the system detects that the free memory in the system available to all applications has dropped below 128K. In response, a window should free as much memory as possible, perhaps by destroying its command bar or freeing cached data.

If the application receives a WM_ACTIVATE message with the `wParam` indicating that the window is becoming active, it should restore any data structures and window objects that were destroyed or freed because of a WM_HIBERNATE message. In our case, the only action that the sample application takes is to recreate the command bar.

In critical low-memory situations, Windows CE displays a dialog asking the user to choose which application to terminate. The selected application receives a WM_CLOSE message telling it to terminate itself. If the application does not close by itself within a few seconds, Windows CE will kill the process automatically.

Since an application can and often will be closing during a low-memory situation, it should be designed so that it does not attempt to allocate large amounts of memory during its cleanup and terminate routines. For example, you might be wise to have a *Save changes?* message box already created but hidden, so that the box can be displayed without having to be created during the close routine.

MORE TO COME

Windows CE offers an entirely new environment for Win32 applications. Its small size and low hardware requirements make Windows CE perfect for handheld computers like the HPC and those even smaller. Rumor has it that Microsoft has extensive plans to use Windows CE in a number of different portable devices. In addition, Windows CE fits into other uses for which the thin-client concept is being pushed.

In a follow-up column, we'll dive deeper into Windows CE programming, looking at how to work with the command bar and how to tune a Windows CE application for a minimal memory footprint. PC

Douglas Boling is a contributing editor of PC Magazine.

Web Markup Matures with HTML 4.0

The new version boasts more design capabilities and extensibility and has fewer proprietary codes.

By Neil Randall

If you've tried to keep up with the changes in HyperText Markup Language (HTML) over the past three years, you might be under the impression that this vital coding language—the heart of the Web itself—is nothing more than a cobbled-together pastiche of the good, the not-so-good, and the nice-but-only-one-browser-supports-it. And you wouldn't be far wrong. New HTML tags and containers appear with each browser release, and it seems to take forever (in Web terms, at least) for the World Wide Web Consortium (W3C) to incorporate these items into the HTML official specification.

That's as it should be, given that the idea is "official specification" and not "cool features," but for site designers, the delays have caused numerous problems. Primary among these is the need to maintain two sets of pages, one geared for Microsoft Internet Explorer and the other for Netscape Navigator. Many HTML tags have been developed for one of these browsers with no regard for the other, and these tags have wreaked a kind of havoc on the whole idea of Web standards.

In 1996, W3C issued the standard for HTML 3.2. The main purpose of this release was to collect and approve many of Microsoft's and Netscape's proprietary codes, simply because they were being widely used anyway. But it was quite clearly a stop-gap measure for use while a more revolutionary HTML version was being developed. The new version, which for several months was code-named Cougar, was designed in part to end the proprietary nature of HTML enhancements. This version won't succeed fully, of course, because it's too important for Microsoft and Netscape to be the first and only kids on the block with new HTML design toys, but at least the potential for controlled expansion of the Web's main authoring code now exists.

Still, that kind of controlled expansion was only one of the issues surrounding the development of HTML 4.0. The other was the increasing need to provide improved page layout and programmability features. These needs have been attended to as well, and the result is an HTML that, even on first reading the specification, seems more mature than before. Just in time, too. With Extensible Markup Language (XML) just around the corner (see "XML: A Second Chance for Web Markup" in the October 21, 1997, Internet Tech column), HTML has been in danger of slipping into minor-league status. This version may cause XML to gain a slower, measured foothold, and the two might very well find a happy coexistence.

EXTENSIBLE HTML, SORT OF

The main problem with HTML so far has been that its list of available tags and containers (a container is a matched set of tags, such as `<CENTER> xxx </CENTER>` for centering) has been fixed from one version to the next. Page authors have had access to an increasing range of design and programming capabilities, but the most advanced authors have always wanted more, and they've wanted that quickly.

To satisfy these desires, Netscape (then Mosaic Communications Corp.) began offering proprietary HTML elements beginning with Version 2.0 of its browser (originally called just Netscape). With the popularity of that browser, these tags started seeing greater and greater use across the Web, a trend that the HTML purists simply couldn't stop. Then, when Microsoft released Internet Explorer, it tossed in a few new tags of its own, and before long you'd commonly see sites offering separate links for Internet Explorer and Navigator users. Or in a worse scenario, sites rendered well in one browser but not the other.

Simply put, HTML has never been easily extensible. Extending it has required first developing the new elements (itself not a difficult task) and then designing or redesigning a browser to display those tags properly (a far harder task). Effectively this problem has made extending HTML possible only for Microsoft and Netscape, since browser share over the past couple of years has gone almost exclusively to those companies. But neither company sets HTML standards, so the de facto process has been for Microsoft and Netscape to introduce their extensions and then submit them for adoption into official HTML by the W3C. HTML 3.2 was largely a case of bundling the best of such existing tags into an official setting.

HTML 4.0 takes a different tack. Here, the idea hasn't been to include as many existing but unofficial elements as possible into the official specification, but rather to enable developers to extend HTML themselves, at least to a degree. Although not nearly as extensible as XML, HTML 4.0 at least makes this possible. And it does so quite simply, through a new element called an *object*. The OBJECT container tells the browser that it is about to encounter one of several types of element, usually multimedia-based. The container will also tell the browser whether it should attempt to render the object or hand over the rendering to an external application.

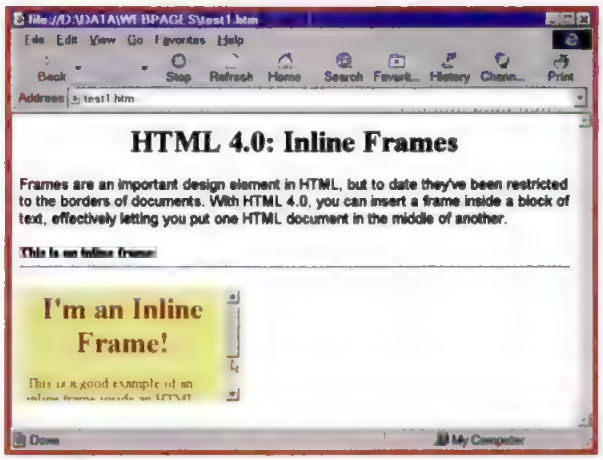

FIGURE 1: *This simple example shows an in-line frame in action, complete with a different background color for the frame than for the main document.*

The OBJECT container can include three main pieces of information: the location of the application that will render the object, the data to be rendered, and any parameters that apply to the rendering. The browser must first attempt to adhere to the full rendering instructions, but if that's not possible, it must try to render the element itself.

One example of an OBJECT type is the image file. Until now, the IMG tag has handled image files, and that need not change. But for the sake of consistency, images are now also object types, and possibly the IMG container could eventually be phased out.

Comparing the two shows the difference:

```
<IMG SRC=http://www.mycomputer.com
/images/1997/meeting01.jpg>
```

and

```
<OBJECT data="http://www.mycomputer
.com/images/1997/meeting01.jpg"
type="image/jpg">
```

Another example shows the new means of including applets in HTML 4.0. Again, either sample is acceptable to HTML 4.0, but the APPLET element could eventually be phased out:

```
<APPLET code="songviewer.class"
width="550" height="600">Click here
to view the sheet music in a Java
applet</APPLET>
```

```
<OBJECT codetype="application/
octet-stream" classid="java:
songviewer.class" width="550"
height="600">Click here to view
the sheet music in a Java
applet</OBJECT>
```

Now, it's clear that in both cases, the pre-4.0 method is shorter and requires less coding. So why bother with the OBJECT container? First, and not insignificantly, treating objects in this way gives HTML greater consistency: All non-HTML file types can be treated as objects, and this means less of a need to learn a host of HTML element names. That makes HTML authoring considerably more structured.

Second, and equally welcome, users will be less likely to see the Download dialog when clicking on a link to a file type not established with the operating system. Since the OBJECT container specifies the MIME type, the operating system doesn't need to know how to treat the file type. The browser can be configured to deal with specific OBJECT types through the helper applications area, and ideally Microsoft and Netscape will increasingly perform this configuration in new browser upgrades.

Finally, the OBJECT container makes HTML officially extensible. Browsers need not be rewritten to display new tags; they need only execute the OBJECT tag as designated, and that's a matter of configuration, not source code programming. Note, however, that this new feature does not make the browsers themselves more capable. They can still display only certain file types, so external applications will still be necessary. But it will be more possible than ever for a developer to come up with a new file type, produce a viewer that will display it, offer the viewer as a download, and include links to the viewer, through HTML's OBJECT container.

It's important, however, not to overstate this case. HTML still isn't anywhere near as extensible as XML, which actually defines markup languages, or Document Type Definitions (DTDs); in fact, all of HTML is just a DTD. XML's ability to define new DTDs means it can offer a much stronger variety of parameters than HTML's OBJECT tag ever will. But OBJECT is a start and may ease the flood of proprietary, browser-specific tags.

FULL-FEATURED FORMS

Compared with the forms in office applications, HTML forms are primitive. They look simplistic and offer little functionality. Designers of HTML forms have had no means of providing features we've come to expect in advanced applications, including such niceties as keyboard shortcuts, interfaces that change as form fields are filled in, labeled buttons, and so on.

> All non-HTML file types can be treated as objects, and this means less of a need to learn a host of HTML element names.

HTML 4.0 goes a long way toward offering far more capable forms. Through the `accesskey` attribute, for example, designers can provide keyboard shortcuts to each field—a feature that will eliminate some of the constant mouse clicking into fields required in earlier HTML forms. Buttons are now possible beyond *Submit* and *Reset* (with the BUTTON element), and you can now gray out buttons through the `disabled` attribute, a fact that will make filling in forms more intuitive. You can now label form buttons with the LABEL element and use the FIELDSET element to group associated fields together. You can set form fields as `readonly` as well. One extremely useful new attribute is `onchange-INPUT`, which lets a form verify input strings.

Of course, features like input verification were possible before HTML 4.0, but only through a data exchange with the server. Users had to press the *Submit* button, then wait for a response telling them whether the input was valid. Forms in HTML 4.0 can assess the input locally, making form use faster and less frustrating.

NEW TABLE FEATURES

Like forms, HTML tables have been far more restrictive than tables in databases or spreadsheets. HTML 4.0 offers both considerable flexibility in table layout and enhanced usability. For example, the `align` attribute offers the standard options for aligning right and left and for centering and justifying, but it now also includes `char` for aligning text in relation to a character. For instance, using `align char`, you can line up numbers around decimal points. The `frames` and `rules` attributes give you further control over table appearance. Framing is possible around a specified combination of a table's sides (right and left sides only, for instance), and you can place rules between cells, rows, or groups of cells.

In fact, a new element called COLGROUP lets you group columns to apply common width, text direction, style information, alignments, and event instructions. And groups of rows support fixed heads and feet, so that tables can scroll while keeping column headings in place. Furthermore, by placing the THEAD and TFOOT containers before the TBODY container, you cause a table's head and foot to appear before the cells are filled in, helping users understand the table as it is rendered in the browser.

AUTOMATION THROUGH SCRIPTING

The new <SCRIPT> container gives HTML 4.0 scripting capability. Such a container includes the URL of the script to be rendered plus the scripting language the browser is to use. The two essential scripting languages are JavaScript and VBScript; a document's META element can specify a default language for all scripts in the document, or it can specify the language as a script appears. Scripts can be executed either when the document loads or, using the `intrinsic event` attributes, whenever a certain event takes place (a mouse click, for example).

The SCRIPT element offers several design possibilities. You can build scripts into forms so that form fields are automatically filled in when a user selects or types a specific value in a field. For instance, date fields could assume a one-day duration, in which case the script would automatically fill in the end-date field after reading the value in the start-date field. You can also use scripts to change the contents of a document as it loads, based on consecutive loading of specified elements. In addition,

you can link scripts to buttons, so that an interactive page can have a button-based interface. Because scripts are executed locally, connection with the server isn't necessary.

IN-LINE FRAMES

Frames are an important design element in HTML, but to date they've been restricted to the borders of documents. With HTML 4.0, you can insert a frame inside a block of text, a feature that effectively lets you put one HTML document in the middle of another. The syntax is simple. Here's an example:

```
<IFRAME src="info.html" width "300"
height "500" scrolling="auto"
frameborder="2"></IFRAME>
```

You can see this example in Figure 1. Placed in an HTML document, this code instructs the browser to call the source document (`src=filename.html`) and display it in the document as a frame of the specified size. All frame attributes are available except `noresize`, because in-line frames can't be resized.

AND MORE

HTML 4.0 offers more than described here. One focus has been on internationalization. The global nature of the Web has meant documents in many different human languages, but until now representing international characters has been difficult. HTML 4.0 adopts the internationalization conventions of RFC 2070, "Internationalization of the HyperText Markup Language," and it adopts the standard ISO/IEC:10646 as the document character set. Thus it allows for a larger array of non-Roman characters.

In addition, HTML 4.0 incorporates the Cascading Style Sheets (CSS) initiative, covered in the Internet Tools column of November 19, 1996. The W3C's goal is to make CSS so attractive that designers will eventually stop using tables for page layout. Even in its earliest incarnation, CSS shows more than enough power to fulfill that goal. Entire document sets can share the same font information, colors, alignments, and other formatting features, and the result is Web sites that offer consistent design throughout.

These features suggest a nearly brand-new take on HTML. Version 4.0 lifts many of the old restrictions on extensibility, page layout, interactivity, and indeed the client/server relationship. All of this means that using the Web should start to feel, at last, like a newer, richer experience. PC

Neil Randall is a frequent contributor to PC Magazine.

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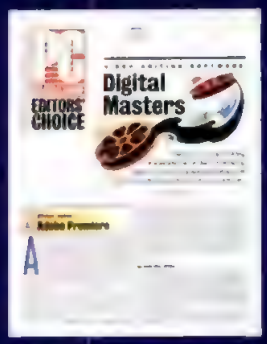

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ExactTime for PC Clocks

ExactTime sets your PC's clock by calling an atomic clock via your modem.

By Charles Petzold

How accurate is the clock in your PC? Not very. The quartz crystals that regulate the clock logic are typically accurate to 0.005 percent. That seems very accurate until you consider that the accumulated errors could amount to 4.5 seconds a day, or 2 minutes a month. Periodically, even the PC's clock needs a little nudge.

You can call up a local time-of-day service and adjust your PC's clock manually, or you can automate the task using ExactTime. ExactTime calls up one of two time-of-day services designed specifically for use by computers and modems, obtains the correct date and time, and sets your system clock. An Auto mode that requires no input lets you use a scheduler utility to run ExactTime automatically at regular intervals. This option also lets you put ExactTime in your StartUp folder so it runs every time you boot up Windows.

Longtime devotees of *PC Magazine* utilities may remember WTime, a similar time-setting program that ran under Windows 3.*x*. But WTime was never updated for Windows 95 and Windows NT. ExactTime is a completely new program designed for these 32-bit versions of Windows.

You can get a copy of ExactTime by downloading it from PC Magazine Online or by mail. (See the sidebar "Getting the Files" for details.) If you're a programmer, you may want to take a look at the C source code for an introduction to modem and telephony programming for 32-bit versions of Windows.

AT THE TONE, THE TIME WILL BE . . . .

Where diplomacy fails, science succeeds. Although the nations of the world cannot agree on politics, languages, or currency, at least we have a standard for time. The world has been marching to the same beat (the beat of a clock, that is) since the establishment of Coordinated Universal Time in 1972.

Coordinated Universal Time, abbreviated UTC as a compromise between the English word order (which produces *CUT*) and the French word order (which produces *TUC*), is what enables a program like ExactTime to boast that it really sets the "exact time." By international agreement, UTC is the same all over the world.

UTC is the scientific name for what is commonly called Greenwich Mean Time (GMT), the time at the 0° line of longitude at Greenwich, England. Your local time is just an offset from UTC, also taking into account daylight saving time. For example, the offices of *PC Magazine* in New York City are 5 hours behind UTC during the winter and 4 hours behind UTC during the summer.

ExactTime

ExactTime calls up time-of-day services, obtains the correct time, and sets your system clock. With an Auto mode that requires no input, you can use a scheduler utility to run ExactTime automatically at regular intervals.

In 1967, an international agreement established the length of a second as the duration of 9,192,631,770 oscillations of the cesium atom. The adoption of the atomic second led to the coordination of clocks around the world and the establishment of UTC in 1972. In 1988, the National Bureau of Standards became the National Institute of Standards and Technology (NIST). The Time and Frequency Division of NIST (which has a fact-filled Web site at *www.boulder.nist.gov/timefreq*) is responsible for coordinating with the International Bureau of Weights and Measures (BIPM) in Paris in maintaining Coordinated Universal Time. The United States Naval Observatory (USNO) also maintains time standards, in particular UT1, which (like many older systems of time) is based on the movement of the earth.

Both NIST and USNO have time-of-day services designed for access by modem. The information they provide consists simply of lines of ASCII characters that encode the current date and time.

NIST runs the Automated Computer Time Service, or ACTS. If you want to see what it's like, you can use the Hyperterminal program in Windows to call ACTS at 303-494-4774. Set your communications parameters to 1,200 baud, 8 bits, 1 stop bit, and no parity. Documentation to decode the information is at *www.bldrdoc.gov/timefreq/service/acts.htm*.

The USNO time-of-day service is also accessible via modem (1,200 baud, 8 bits, 1 stop bit, and no parity) at 202-762-1594. You can get documentation of the output at *tycho.usno.navy.mil/modem_time.html*.

HOW TO USE EXACTTIME

You install ExactTime by copying its program files to a folder on your hard disk. When you run ExactTime, you'll see the window shown in Figure 1. The two radio buttons at the top let you select whether the program will call the NIST or the USNO. Pick whichever site is closest to you; you'll be connected for less than a minute.

This is usually the only selection you'll need to make. But if you need to change your modem settings or dialing location, ExactTime lets you do this without opening Control Panel. The *Configure Modem* and *Dialing Properties* buttons invoke the same dialog boxes as the *Properties* and *Dialog Properties* buttons in the Modems applet of Control Panel.

When you press the *Dial* button, ExactTime saves the time-of-day service and modem you selected in a file named Exacttime.ini. The location you're calling from is

FOR PROGRAMMERS ONLY ExactTime is a TAPI application written with Microsoft Visual C++. The full source code for ExactTime is available from PC Magazine Online (*www.pcmag.com*) and demonstrates the following programming techniques:

- using the TAPI functions needed for basic communications programming;
- allocating a variable-length structure such as LINEDEVCAPS;
- handling overlapped communications;
- setting up a SYSTEMTIME structure.

SUPPORT Help for *PC Magazine*'s free utilities can be obtained in our online discussion areas, both on the World Wide Web (*www.pcmag.com/discuss.htm*) and on ZDNet in the Utilities section of ZDNet's TIPS Forum (GO ZNT:TIPS). The authors of current utilities generally visit this forum daily. You may find an answer to your question simply by reading the messages posted in the forum. If the author is not available and the forum sysops can't answer your question, the Utilities column editor, who also checks this forum each day, will contact the author for you.

WWW.PCMAG.COM

saved elsewhere in Windows. ExactTime then displays the Dialing dialog box shown in Figure 2, which reports on the progress of the telephone call.

ExactTime will report any problems it encounters while attempting to connect to a time service. For example, the modem may be in use by another program on your PC, or the phone number may be busy, or the time service may not answer. You can also stop any dialing in progress by pressing the *Cancel* button.

If ExactTime successfully connects, you'll see a few lines of coded input from the time service and then ExactTime will set your system clock. The status line at the top of the dialog box will display the previous local time and the new local time, and the *Cancel* button will change to an *OK* button. Click *OK* to close the Dialing dialog box.

If you're running Windows NT 4.0, you must be logged on under a user name with the right to change the system time, or ExactTime will not work. To find out if you have this privilege, try changing the system time from within Control Panel. If the system will not let you do it, you will not be able to use ExactTime, either.

So that you can automate your clock setting using a scheduling utility (such as System Agent, which comes with the Windows 95 Plus! pack) or the StartUp folder, ExactTime offers Auto mode. Under Auto mode, the program will display the usual windows and run normally, but it won't require any input from you. In order to run ExactTime in Auto mode, include any parameter in the command line in the utility you're automating with, for example:

```
C:\PCMAG\EXACTTIME\EXACTTIM.EXE auto
```

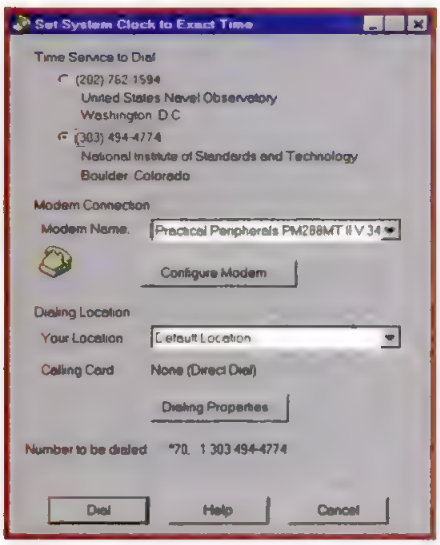

FIGURE 1: *The opening window of ExactTime lets you select the time-of-day service you want to call, which modem you wish to use, and where you're calling from.*

COMMUNICATIONS AND TELEPHONY

Before the era of Windows, programmers needed to access the hardware of the serial communications port directly. When a hardware interrupt signaled that a byte had been successfully transmitted or received, a driver would output another byte from the output queue or input another byte to the input queue. The application would jump between checking for the presence of keystrokes from the user and checking for the presence of bytes in the input queue.

The early versions of Windows included a fairly complete and usable API for serial communications that lasted through Windows 3.1. The driver maintaining the input and output queues was built into the system, and that made things a bit easier. Yet reading bytes from the input queue was still tricky. The normal message loop in the Windows program needed to be rewritten to alternate between calling PeekMessage and ReadComm calls, and applications checked for possible input characters in their spare time.

This finally changed under multithreaded, 32-bit operating systems such as Windows 95 and Windows NT. No longer do programs have to jump back and forth between looking for communications input and looking for user input. A second thread can efficiently handle the job of reading the communications port.

Another difference is in the call to open a communications port. Rather than using a special OpenComm function, applications (or a Windows subsystem working on behalf of an application) now call `CreateFile` using "COM1" or "COM2" as a device string. `CreateFile` is the same function that creates or opens a disk file. Similarly, programs call `ReadFile` and `WriteFile` to read from and write to the communications port.

The 16-bit communications API in earlier versions of Windows was largely replaced in 32-bit Windows with the Telephony API, or TAPI, which greatly expands the scope of computer-based communications. One handy application of TAPI that you're probably familiar with is the ability to change your dialing location. TAPI addresses this problem and many, many more.

Telephony encompasses the wide range of ways in which the personal computer can be connected to the telephone system, including interfaces to voice mail, conference calls, caller ID, automatic dialing, ISDN boards, fax functions, and modems.

For the programmer, TAPI is scary, huge, and confusing. There are over 400 pages of documentation for TAPI 2.0. I would have been lost without the sample TapiComm program included in Visual C++ 5.0 and the Microsoft Press book *Communications Programming for Windows 95*, by Charles A. Mirho and Andre Terrisse.

TAPI AND PHONE NUMBERS

TAPI's handling of phone numbers is a major convenience. Programmers don't have to parse phone numbers at all. The dialable and displayable addresses are available through a call to `lineTranslateAddress`. The function takes as input a phone number in its canonical form (indicated by the plus sign), such as +1 (202) 762-1594. The 1 is the country code for the United States.

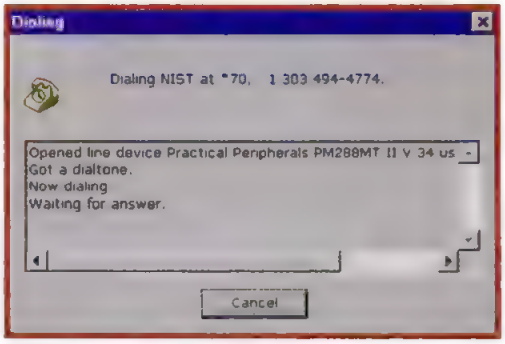

FIGURE 2: *As ExactTime dials the time-of-day service, it displays status information about the phone call in this dialog box.*

Based on the current selected location and other information specified in the Dialing Properties dialog box, `lineTranslateAddress` creates a dialable address and a displayable address. For example, if you're calling from a hotel in Washington, D.C. (area code 202), and the room phones require dialing a 9 to get an outside line, the displayable address is 9 762-1594. A program such as ExactTime can show this number to the user (which it does).

The dialable address that `lineTranslateAddress` creates is generally the same as the displayable address except that it's preceded by a *T* for Touch-tone dialing or a *P* for pulse dialing.

THE TAPI FUNCTION PARADE

ExactTime calls 14 TAPI functions in addition to `lineTranslateAddress`, all beginning with the prefix `line`. (Other TAPI functions use the prefixes `phone` or `tapi`.) A "line device" is a physical device that is connected to a telephone line, such as a fax board, a modem, or an ISDN card. For ExactTime, the line device we're interested in is a modem. Going through the TAPI calls that ExactTime must make is a good way to

understand both ExactTime and the nature of TAPI programming.

ExactTime calls its first TAPI function, `lineInitialize`, in the WM_INITDIALOG message handler for SetupDlg (the window you see when you first invoke the program). This function returns an application handle for use by other TAPI functions, and also the number of line devices on the system. If `lineInitialize` fails, then the program cannot use TAPI at all. If it succeeds, then in subsequent function calls each line device can be identified with a device ID, ranging from 0 to the number of line devices minus 1. When the program terminates, it closes this application handle with a call to lineShutdown.

To populate the list of modem names in the window's combo box, ExactTime calls its `FillUpModemNames` function. `FillUpModemNames` loops through the line devices and for each device calls the program's `GetTapiVersion` function. `GetTapiVersion` uses the TAPI function `lineNegotiateAPIVersion`. Because the capabilities of a particular line device depend on its device driver, different devices may support different versions of TAPI. The version prevalent in Windows 95 and Windows NT 4.0 is TAPI 1.4, which is what I've focused on. Device drivers that will support TAPI 2.0 (I haven't seen one yet) will also support TAPI 1.4.

Next, `FillUpModemNames` gets the device capabilities of each line device in the system by means of a call to the TAPI function `lineGetDevCaps`. This function returns information in the LINEDEVCAPS structure. The structure definition itself looks innocent enough, but it doesn't tell the whole story. Some of the fields are offsets measured from the beginning of the structure that point to memory locations beyond the end of the structure. These memory locations are used to store variable-length information, such as the modem name.

You just can't define a structure of type LINEDEVCAPS and pass it to `lineGetDevCaps`. First, you must define a pointer to the structure and a structure size. Then you can allocate memory for the structure and set the `dwTotalSize` field of the structure to the size of the allocated memory block. Once this is done, you can call `lineGetDevCaps` with the `pldc` pointer.

But you're not finished yet. So far, the structure size is sufficient only for the structure definition itself and not for the data that lies beyond the end of the structure. On return from `lineGetDevCaps`, the `dwNeededSize` field of the LINEDEVCAPS structure tells you how much memory the function really requires, so you must reallocate the memory. Once you've done this you can call `lineGetDevCaps` again. But wait!

According to TAPI documentation, the structure is still not guaranteed to be of sufficient size! On return, the `dwTotalSize` field could be still larger. You must continue to reallocate the memory block until the `dwNeededSize` field is less than or equal to `dwTotalSize`. In ExactTime, I've put the logic in the do-while block.

When the memory block is finally of sufficient size, you can access information beyond the end of the structure. For example, here's a pointer to the modem name:

```
(char *) pldc + pldc->dwLineNameOffset
```

Not every line device is eligible for inclusion in the combo box. For example, your system may have a serial port that doesn't have a modem connected to it. Information in the LINEDEVCAPS structure helps you determine this. ExactTime accepts a line device only if the LINEBEARERMODE_VOICE flag is set in the `dwBearerModes` field, the LINEMEDIAMODE_DATAMODEM flag is set in the `dwMediaModes` field, and the LINEFEATURE_MAKECALL flag is set in the `dwLineFeatures` field.

Back to the WM_INITDIALOG message handler in `SetupDlg`: When the user has selected a modem, the `lineGetIcon` function obtains an icon to represent it and displays the icon in the dialog box. From what I've seen, these icons all look the same (a telephone sitting on an external modem), but it's conceivable that every modem driver could have a different icon.

Setting up the list of dialing locations in the combo box is the responsibility of ExactTime's `FillUpLocationNames` routine. This involves another wacky structure named LINETRANSLATECAPS and a call to `lineGetTranslateCaps`. The word "translate" here may be confusing, but the term refers to the translation of a phone number from its canonical form to its displayable and dialable forms. ExactTime calls `lineSetCurrentLocation` based on the location the user selects from the combo box.

The *Configure Modem* button is handled by a simple call to `lineConfigureDialog`; the *Dialing Properties* button is handled by a simple call to `lineTranslateDialog`. The displayed telephone number is obtained from `lineTranslateAddress`, which I discussed earlier.

When everything is ready and the *Dial* button is clicked, ExactTime opens a smaller dialog box with the caption *Dialing* using the window procedure `CallDlg`. ExactTime calls `lineOpen` in the WM_INITDIALOG message handler of `CallDlg`. This returns a handle for the particular line device (that is, the modem device) that the user has selected. Eventually, the line must be closed with a call to `lineClose`.

We want to make a phone call on this device, so the next function is `lineMakeCall`. One of the parameters is the dialable phone number. The function returns a "call handle" to refer to this particular call. Eventually this function must be balanced with the `lineDrop` function.

Up until `lineMakeCall`, all the TAPI functions I've discussed have been synchronous. That is, the functions do something and return control to the program, like normal functions. The `lineMakeCall` and `lineDrop` functions, however, are necessarily asynchronous since what they do requires time. The `lineMakeCall` function isn't finished until the modem has established a connection or given up trying.

The `lineMakeCall` and `lineDrop` functions report their progress in a callback function that was originally defined way back in the `lineInitialize` function. In ExactTime, this callback function is named `TapiCallBack`. Interestingly enough, this callback function is *not* called in a second thread but is called in the same thread that calls the TAPI functions. Since the callback function isn't invoked until the program calls `GetMessage` in its message loop, there's no delay if the callback function uses `SendMessage` instead of `PostMessage` to pass the information back to the window procedure. This is what ExactTime does, with a user-defined message of WM_USER_TAPI_CALLBACK.

The callback messages report the progress of the `lineMakeCall` and `lineDrop` functions. The callback message LINE_REPLY is the first message the callback function receives after the two functions are called. My experience is that the only other message is LINE_CALLSTATE, which results from the `lineMakeCall` function and indicates the progress of the phone call. When the program receives a LINE_CALLSTATE message with a dwParam1 parameter of LINECALLSTATE_CONNECTED, it's ready to go on to the next step.

OVERLAPPED COMMUNICATIONS

When you use TAPI, you don't call `CreateFile` directly to obtain the handle to the communications port. Instead, the `lineGetID` function calls `CreateFile` for you. In ExactTime.c, `lineGetID` is called in the `GetCommHandle` routine. The `lineGetID` function uses a variable-length structure named VARSTRING, and it returns both a handle to the communications port and the name of the modem.

The communications handle that `lineGetID` obtains for you is created with the "overlapped flag" (FILE_FLAG_OVERLAPPED), one of the parameters to the `CreateFile` function. Information about this flag, which is crucial for serial communications, is not contained in the function documentation. Rather, the informa-

tion is in the documentation for the device classes, since the returned value depends on the device type.

Here's how it works. Normally, the ReadFile and WriteFile functions are synchronous. That is, you specify in the function call a number of bytes to read from or write to the file or device, and the function does not return until that number of bytes have been read or written or an error occurs. But when you specify FILE_FLAG_OVERLAPPED in the `CreateFile` function, the `ReadFile` and `WriteFile` functions are asynchronous. These functions *can* return—and often *do* return—before the specified number of bytes are read or written. For file I/O, using this flag can help in dealing with slow mass storage devices while remaining responsive to the user.

If a communications port is opened without the overlapped flag, calls to `ReadFile` will not return until the requested number of bytes are available, or some kind of error occurs such as a loss of connection. In a single-threaded application, this would be a disaster. The application would be effectively halted until `ReadFile` returned.

In a single-threaded application, you should use overlapped I/O. To perform a read operation, you first call `ReadFile`, specifying an input buffer and the number of bytes you want to read. Another parameter to `ReadFile` is a pointer to a variable that on return from the function indicates the number of bytes actually read. `ReadFile` returns TRUE if it reads all of the bytes you requested. Otherwise the function returns FALSE, indicating an error, which means the function has read fewer bytes than requested or perhaps none at all.

If `ReadFile` returns FALSE to indicate an error, then the application calls `GetLastError`. If `GetLastError` returns ERROR_IO_PENDING, then it means that everything is proceeding normally. To get the remainder of the bytes requested, the application calls `GetOverlappedResult`. This function contains a parameter that indicates whether the function should wait for all of the input to be read. In a single-threaded application, this parameter should be set to FALSE so the function doesn't wait. `GetOverlappedResult` returns TRUE if all the data originally requested by the `ReadFile` call has been read, and FALSE otherwise, in which case `GetLastError` returns ERROR_IO_INCOMPLETE.

Thus, in a single-threaded application, the application alternates between calling `GetOverlappedResult` with no waiting and doing everything else it needs to do. In practice, the call to `GetOverlappedResult` would probably be part of a modified message loop, just as in the old days. This is not the best approach in a multitasking environment.

In a multithreaded application, opening a communications port without the overlapped flag is perfectly acceptable. The application is designed so that a second thread calls `ReadFile`, so it doesn't matter if the function spends some time waiting for data. The primary thread can still interact with the user.

The communications handle that the TAPI function `lineGetID` obtains for you is created with the overlapped flag, however, and you cannot change this. This lets you use the communications port in a single-threaded application as I've described above, but I chose to put the read logic in a separate thread, called `CommReadThread`. Because it is a second thread, it can call `GetOverlappedResult` with the wait option set to TRUE. This means that `GetOverlappedResult` won't return until all the characters have been read, and it won't return FALSE unless an error has occurred.

ASCII TO SYSTEM TIME

`CommReadThread` reads the lines of ASCII text from the time-of-day service and funnels them back to the `CallDlg` window procedure, which displays them and calls `ProcessString`. The `ProcessString` function is responsible for parsing the strings and setting up a SYSTEMTIME structure containing the new date and time. This is the structure used by the four Windows date and time functions: `GetSystemTime`, `SetSystemTime`, `GetLocalTime`, and `SetLocalTime`. The first two functions are for UTC; the second two are for local time. As we've learned, local time is UTC time with an offset that adjusts for time zone and possibly for daylight saving time.

Both the NIST and the USNO services report the date in terms of the so-called "modified Julian date" (MJD), which is the last five digits of the Julian date, or the number of days since January 1, 4713 B.C. My conversion formula is:

```
iYear = 1904 + (int) ((iMJD - 16480)
/ 365.25) :
```

This works for every year between 1904 and 2099. To guard against transmission errors, ExactTime looks at two strings in a row and makes sure that they differ by only a second.

From the time-of-day service ExactTime gets the UTC time. In order to report the time change to the user, it needs local time. ExactTime plays it safe and doesn't attempt to convert between UTC and local time itself. Instead, when setting the time it first calls `GetLocalTime` to get the current local time and then calls `SetSystemTime` to set a new time. A second call to `GetLocalTime` obtains the new local time.

ExactTime only scratches the surface of what is possible with TAPI, but it does demonstrate the basics. It also lets you synchronize your system's clock with the atomic clock that keeps time for the whole world. PC

Charles Petzold is a contributing editor of PC Magazine.

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User-to-User

By Neil J. Rubenking

Maximize Environment Space for Batch Files

I discovered a way to wipe the environment clean instantly (and temporarily) to give more maneuvering room to a batch file. My method even wipes out those pesky "winbootdir" and "windir" variables, which are otherwise bulletproof. This means no more worrying about whether a variable name already exists.

Normally, when you use COMMAND to launch another session, you get a copy of the current environment. But there's an easy way to stop that: Run COMMAND specifying a path for COMMAND.COM. You don't have to (but you can) specify a valid path. As Figure 1 shows, this empties the environment.

To call your environment-intensive batch file, forget about using CALL. Instead, use `command \ /c test.bat`. *The backslash is the command path. It might even be valid on your system; but it doesn't matter. Be careful when using this technique, because the entire environment is gone until you exit. That means no PATH and no access to any commands not in the current directory, so you might want to make a copy of your PATH before proceeding. Figure 2 shows an example batch file. Note that I used "noenvironment" as the command search path to make the batch file a little more self-documenting.*

Eric Phelps
Sacramento, California

PC MAGAZINE: When you enter the command PATH at a DOS prompt, the system responds with a line of the form PATH=d:\directory.... Executing this same line sets the PATH environment variable to the specified value.

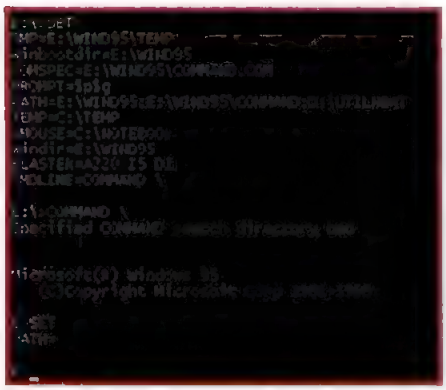

FIGURE 1: *Entering* command *launches a secondary command processor; if you add a pathname to the command line, the command processor's environment starts out empty.*

Taking advantage of this fact, I modified the reader's example batch file to restore the path automatically. The line that enables this feature is marked with a comment; you may delete it if you prefer. If you do not restore the PATH, you will have to spell out the full pathname of any programs your batch file invokes.

```
@ECHO off
CLS
ECHO Here is the original
environment:
set
ECHO @ECHO off > TEST.BAT
ECHO ECHO. >> TEST.BAT
ECHO ECHO Here is the clean
environment: >> TEST.BAT
ECHO set >> TEST.BAT
:: The next line causes the path
   to be restored
PATH >> TEST.BAT
ECHO ECHO Here is the path-only
environment: >> TEST.BAT
ECHO set >> TEST.BAT
command noenvironment /c TEST.BAT
del TEST.BAT
ECHO.
```

FIGURE 2: *As shown here, if you include a path when invoking COMMAND.COM, it starts up with an empty environment.*

Not every batch file is compatible with this method of maximizing available environment space. Some batch files depend on getting data from the environment, and others are designed to pass information back to the system using environment variables. But for a batch file that needs to use a lot of environment space internally, without using the environment to communicate with the system, this technique is ideal.

Security Problem in Windows 95

I discovered a potential network security problem under Windows 95 that occurs when you add partitions. It may also occur if you add another drive. My system included a CD-ROM as a shared drive designated D:. When I added a new partition, the CD-ROM drive became E:, but I discovered that drive D: was still designated as shareable. I didn't notice this immediately, so until I did I was sharing my D: drive and all its contents with the world.

Tom Story
via the Internet

PC MAGAZINE: If you have enabled file sharing from Control Panel's Network applet, the context menu for each drive and folder will include an item called Sharing. By invoking this item, you can set that drive or folder to be shared for read-only access or for full access, and you can define a password for each kind of access. Commonly this feature is used to share resources across a network, like the CD-ROM drive mentioned above.

However, changes to your system configuration can change the letters assigned to different drives. For example, drive letters will change if you add or remove a hard disk, or if you change the number of partitions on a disk. If your system is configured to share some drives but not others, a drive letter shift could cause problems. On such a system, you should double-check the file-sharing properties of each drive after any change to the drive letter layout.

Get More from Explorer

I just discovered that in Windows 95 and Windows NT 4.0, if you hold down the Shift key when you double-click on My Computer, you actually launch Explorer!

Jim Needham
via the Internet

PC MAGAZINE: If you right-click on My Computer, you get a menu with a number of options, including Open and Explore. Open is the default action, displayed in boldface and triggered when you double-click on the icon. The Open action launches Explorer in its single-pane view, while the Explore action launches Explorer in its more informative two-pane view. You can shift-double-click on the My Computer icon to go straight into the two-pane view. The same is true of any folder.

Here's how to change the default action to Explore so you always have the two-pane view.

1. Choose Options from Explorer's View menu, and click on the File Types tab.

2. Scroll down the list until you find the Folder type (not the File Folder type) and click on the Edit button.

3. In the resulting Edit File Type dialog, click on explore in the list of actions and click on the Set Default button.

4. Close the dialog and the View Options dialog. From now on, double-clicking on My Computer or any folder will give you the double-pane view. You can still get the single-pane view by selecting *Open* from the right-click menu.

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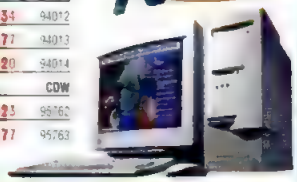

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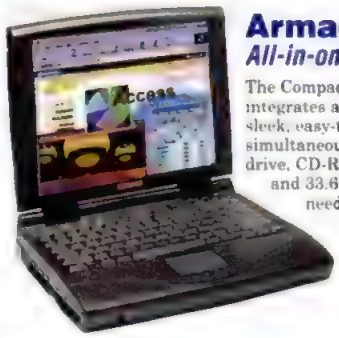

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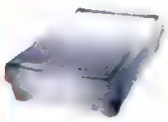

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Ask Our Advisors

HARDWARE

Disk Drive Dilemma

If I install both an IDE drive and a SCSI drive in a system, how does the computer know which to assign as drive C: and which as D:? If I wanted the SCSI to be the C: drive and the IDE the D: drive, how would this be done?

JAMES ST. JAMES
via the Internet

PC MAGAZINE: For most computers, you will have to settle for the IDE drive taking on the role of boot drive and drive C:; your SCSI drive will be relegated to a position further down the alphabet.

The computer assigns the drive C: and boot responsibilities to the first active primary DOS partition it encounters. If you have an IDE installed as master on the primary IDE channel, it must have a primary DOS partition; thus, your IDE drive will become C:.

The one exception is with a newer system that has a BIOS that lets you choose between the SCSI and IDE interfaces for the boot drive. The way to determine whether your computer supports this feature is to check the CMOS configuration settings.—*Alfred Poor*

Shortchanged SCSI

I just bought a flatbed scanner that came with a 25-pin SCSI board. The scanner works great. Then, to store all my scanned images, I bought a Jaz drive with the Iomega cable adapter, which I connected to the back of my scanner. I made sure to give them different addresses. But although my scanner still works fine, I can't even load the Jaz software, because the install program shuts down when it gets "no Iomega adapters found." How can I get them both to work?

LARRY KINGSLEY
via the Internet

PC MAGAZINE: Most color flatbed scanners are designed for a SCSI interface, and almost all of these come with a SCSI adapter card. Unfortunately, not all SCSI cards are alike, and your only solution is to get a different adapter.

One of the big advantages of the SCSI bus is that you can easily attach additional SCSI devices to the chain, up to seven devices in all with the SCSI and SCSI-2 standards. To save some money, however, some scanner manufacturers bundle a SCSI adapter that can work with only a single device. To attach additional peripherals, you need to replace the single-unit card with a full-capacity SCSI interface.

There are other good reasons to replace the card, however. The bundled cards are often 8-bit or 16-bit ISA cards, which are limited to approximately 4-MBps and 8-MBps transfer rates respectively. A Fast SCSI-2 bus is capable of up to 20 MBps, and for fast devices, the ISA cards just can't keep pace. If your motherboard has a PCI or VL-Bus slot available, replacing the bundled card with a PCI or VL-Bus local-bus SCSI adapter could significantly boost performance for the devices you connect to it.—*Alfred Poor*

OPERATING ENVIRONMENTS

Disabling CD-ROM Auto-Play

Whenever I insert a CD-ROM, Windows 95 auto-scans it and, of course, brings up a window containing an introduction by the manufacturer. This can be very annoying to someone like me who swaps out CD-ROMs constantly, and it's especially annoying if I'm working in DOS and just want to listen to music on a game CD-ROM. How do I make Windows 95 not auto-scan CD-ROMs, or at least not bring up a window for them?

DAVE ARIAS
Arlington Heights, Illinois

PC MAGAZINE: A key in the Registry will solve your problem. Run RegEdit and navigate to the key HKEY_CURRENT_USER\Software\Microsoft\Windows\CurrentVersion\Policies\Explorer. In the right-hand pane you should see several named values. Double-click on the value named NoDriveTypeAutoRun. The default hexadecimal value for this 4-byte binary key is expressed as 95 00 00 00. Each bit in the first byte represents a kind of drive for which AutoRun should *not* be enabled:

01h	Unknown drive type
02h	Drive without root directory
04h	Removable drive
08h	Fixed drive
10h	Network drive
20h	CD-ROM
40h	RAM disk
80h	(future device types)

The standard value suppresses AutoPlay for unknown drives (01h), removable drives (04h), network drives (10h), and as-yet-undetermined drives (80h). Sum those values and you get 95h, the value of the first byte in the Registry entry. To suppress AutoPlay for CD-ROM drives, add 20h to that value. In hexadecimal arithmetic, 95h + 20h = B5h. Double-click on NoDriveTypeAutoRun and change its value to B5 00 00 00. Now close RegEdit right away, so you don't make any other changes accidentally

The same procedure works in Windows NT 4.0, using the same Registry key. Don't substitute "Windows NT" for "Windows" in the key! The only difference is that you must restart Explorer before the change takes effect.—*Neil J. Rubenking*

Adding an Option to the Standard Context Menu

A recent PC Solutions item indicated that if you hold down the Shift key and right-click on a file, Open With *would be added to your list of choices. Is there a way to add this option to your list permanently without having to hold down the Shift key?*

TIM LEBRUN
via the Internet

PC MAGAZINE: Yes, there is, and I'm surprised I didn't think of it sooner. Here's what to do.

Launch RegEdit from the Start menu's *Run* command, and click the boxed plus icon

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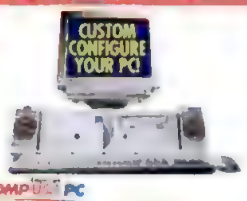

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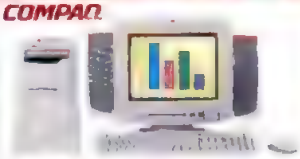

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to the left of HKEY_CLASSES_ROOT. Scroll down to the key named "Unknown," which you'll find almost at the end of the file. The key has a subkey named "shell," which has a subkey named "openas," which in turn has a subkey named "command." When you select the command key, you'll see in the right-hand pane that the (default) value is a complicated command line involving Rundll32.exe. Double-click on this value to open the editor, press Ctrl-C to copy that long command line, and then click on *Cancel*. You don't want to make any changes yet!

Now go back to the top of the list and find the key named "*" (asterisk). Right-click on it and choose *New Key*. Name this subkey "shell." Right-click on the shell key and add a new subkey named "openas." Right-click this key and add a new subkey named "command." Now double-click the word (default) in the right-hand pane to open the editor. Press Ctrl-V to paste the complicated command line you copied earlier. Click *OK* and then close RegEdit.

You now have an *Open with . . .* menu choice on every file's context menu. And because you've copied it from the fully functional *Open with . . .* command used for file types not registered with the system, it's sure to work.—*Neil J. Rubenking*

WORD PROCESSING

A Change in Tables in WordPerfect 8

The table feature in WordPerfect 8 adds a number of useful new capabilities—such as the ability to drag the horizontal grid lines to change row height—but it also seems to have developed a new quirkiness about spilling over onto a second page. Some tables I've created have no problem growing beyond a page break; others refuse to do so. Is there a setting I've missed that WordPerfect users should know about?

ROGER STROUD
via PC Magazine Online

PC MAGAZINE: Corel WordPerfect 8 offers two basic ways to create a table. You can choose *Insert | Table* to open the Create Table dialog box and select the number of rows and columns you'd like, or you can choose the *Table QuickCreate* button (fifth from the right on the toolbar) to open a pull-down grid, which you can drag across to define the number of rows and columns.

Each of these approaches has two variations. One variation for each limits the table to one page. The other lets you expand the table across page breaks, but it may prevent a cell from falling on two pages, depending on the setting for the *Allow Row to Span Pages* check box.

One new option lets you drag the mouse across the document to define a new table. Choose *Insert | Table* to open the Create Table dialog box, and make sure the check box labeled *Drag to Create a New Table* is selected. (The option will stay active until you open the dialog box again and remove the check.)

Then define the number of rows and columns you need and choose *Create*, or click on the *Table QuickCreate* button, drag to define the number of rows and columns, and release the mouse button. WordPerfect will

> WordPerfect 8's table feature adds new capabilities but has a quirkiness about page spanning.

return you to the document with a mouse pointer that looks like a hand holding a small, dotted square. You can position the pointer where you want one table corner to be, click the left mouse button, and drag to the diagonally opposite corner. When you release the mouse button WordPerfect will create the table, which it will insert in a graphic box it creates along with the table.

This graphic box makes it easy to move the table anywhere on the page: Click once on the table to select it, move the mouse over the outline of the graphic box so the pointer changes to four arrows, and then click the left mouse button and drag the table. (You can also put a table in a graphic box in WordPerfect 7, but you have to create the box and table in two separate steps.) But a graphic box cannot span a page break, which means the table is limited to a single page. If you'll need to span a page break, create the table without putting it in a graphic box. Start by making sure the *Drag to Create Table* option is off: Choose *Insert | Table* and make sure the option's check box is not selected. Then create the table using either the dialog box or the *Table QuickCreate* button. WordPerfect will insert the table into the document without adding a graphic box, and the table will be able to spill over a page break.

If you've already inserted a table in a graphic box and then realize that you need to span a page break, you can copy the table from the graphic box to the document, but this isn't as straightforward as you might expect. Move to the upper-left cell in the table and hit the Left Arrow key until you've moved the cursor to the left of the table. Then hit Enter once to insert a blank line above the table. Select everything in the graphic box, including the blank line above the table. Choose *Edit | Copy*, position the cursor where you want to insert the table in the document, and choose *Edit | Paste*.

You can now delete the graphic box and the table in it by selecting the box and choosing *Edit | Cut*. If you want to select the box rather than the table, first click on the table so you can see the box outline; then click on the outline of the box. The cursor will disappear from the table, indicating that you've selected the box itself. Alternatively, you can hit Alt-F3 to show codes, select the box code, and choose *Edit | Cut*.

Finally, you can choose whether an individual row will be able to split across a page. If you need a row to extend to another page, place the cursor or selection in the row, choose *Table | Format* from the Tables property bar, choose *Row*, and make sure the *Divide Row Across Page* check box is checked. —*M. David Stone*

SPREADSHEETS

Changing Tab Fonts

How do you change the font that Excel 97 uses for its worksheet tabs?

TOM BARTOFFT
via the Internet

PC MAGAZINE: It appears that the only way to do this is to alter the size of your scroll bars. You can do that by going to the Display applet in Control Panel, choosing the Appearance tab, clicking on a scroll bar in the sample display, and then changing the Size value. As you expand or reduce your scroll bars, Excel adjusts the width of its sheet tabs and modifies the font to fit.—*Craig Stinson*

Finding the Highest Values

In my work as a teaching assistant, I frequently need to compute the average of the top n *scores for each student, since the students are allowed to drop a number of their lowest grades. My worksheet records the scores for all the assignments. How can I get Excel to give an average or a sum of only a certain number of the highest grades?*

BRIAN CUNNINGHAM
via the Internet

PC MAGAZINE: If *n* is relatively small, you could easily use the LARGE function. For example, to get the average of the top five scores in

range B2:B10, you could write,

```
=AVERAGE(LARGE(B2:B10,1),
LARGE(B2:B10,2), LARGE(B2:B10,3),
LARGE(B2:B10,4), LARGE(B2:B10,5))
```

Alternatively, you could enter the code in Figure 1 into a VBA module. (Type Alt-F11 to open the VBA editor, choose *Module* from the Insert menu, and type the code.) This code creates two custom functions, one to calculate the sum of the top *n* values in a range and a second to calculate the average of those values. To get the average of the 15 highest scores in B2:B21, for example, you could write,

```
=AvgTopN(B2:B21,15)
```

SumTopN employs Excel's built-in RANK function, which reports the rank of a particular cell or value lying in a specified range. For example, the formula

```
=RANK(B7,B2:B21)
```

returns 4 if the value of cell B7 is the fourth-highest in B2:B21. If you hard-code a number in RANK's first argument instead of referencing a cell, that number must be one of the values in the specified range. For example, if you write,

```
=RANK(42,B2:B21)
```

and none of the cells in B2:B21 contain the value 42, RANK will return an #N/A error.
—Craig Stinson

```
Function SumTopN(inputrange, n)
   For Each cell In inputrange
       If Application.Rank(cell, inputrange) <= n Then
           total = total + cell.Value
       End If
   Next cell
   SumTopN = total
End Function

Function AvgTopN(inputrange, n)
    AvgTopN = SumTopN(inputrange, n) / n
End Function
```

FIGURE 1: *This VBA code creates a custom function to calculate the sum of the top* n *values in a range, and it creates a second one to calculate the average of those values.*

DATABASES

Calculated Fields in Queries

Your response to a reader in the issue of May 27, 1997, was awesome. Although I'm not a beginner, I'm not able to program to that extent. I tried an expression in a query and could not get it to run. It went like this:

```
Expr1: If [Section]='8'
then [Net LH]=[Line Haul]-260
else if [Section] = '5'
then [Net LH] = [Line Haul]
- .015 * Weight
```

Is there a book that contains lots of real-world expressions? Seeing other examples would be an immense help. The books I have examined are short on examples, and the ones they include pertain mostly to dates.

A. KAY PETERSEN
via the Internet

PC MAGAZINE: When you use an expression to add a custom column to a query, you create what Access calls a *calculated field.* The `If . . . Then` sequence in your query, however, is a statement containing an assignment, not an expression. An expression is a combination of keywords, variables, operators, functions, and constants that yields a string, number, or object. The key point to remember is that the expression must yield a value.

For instance, your example would work if you entered it in the Field cell in the query design grid like this:

```
[Net LH]: IIF([Section]='8',
[Line Haul]-260, (IIF([Section]='5',
[Line Haul]-.015*[Weight],)))
```

In this case the Immediate If (`IIF`) function returns a value that Access places in the Net LH column in your query result. Remember, expressions evaluate to a value, statements do not.

Note that this expression will fail to return a numeric value if `Section` is not 5 or 8. In that case the expression will return Null—a special indicator that means an absence of value. If `Section` will always be either 5 or 8, this is not a problem, but because that usually isn't the situation, you would normally want your code to take care of all other possibilities. In your example, the solution might be as simple as just returning a value of 0 when `Section` is anything other than 5 or 8, like this:

```
[Net LH]: IIF([Section]='8',
[Line Haul]-260, (IIF([Section]='5',
[Line Haul]-.015*[Weight],0)))
```

Note that you can choose to create your own function in Visual Basic to return a value, then employ it in a calculated field in your query. You would do this in your case if you had several other values in the [Section] column in addition to 5 and 8. In that case your entry in the Field cell in the query grid could be

```
[Net LH]:CalcNetLH([Section],
[Line Haul],[Weight])
```

and you would create the CalcNetLH function in a module in your database. It would look something like this:

```
Function CalcNetLH(S, L, W)
Select Case S
 Case 5
  CalcNetLH = L -.015 * W
 Case 8
  CalcNetLH = L - 260
 Case Else
  CalcNetLH = 0
End Select
End Function
```

You would add a Case sequence to the function for each value of [Section].

I don't know of a book like the one you describe, but in the issue of June 10, 1997, I recommended a number of books and resources for learning Access programming.
—Sal Ricciardi

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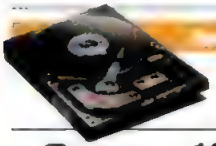

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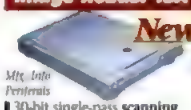

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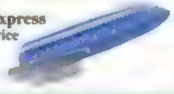

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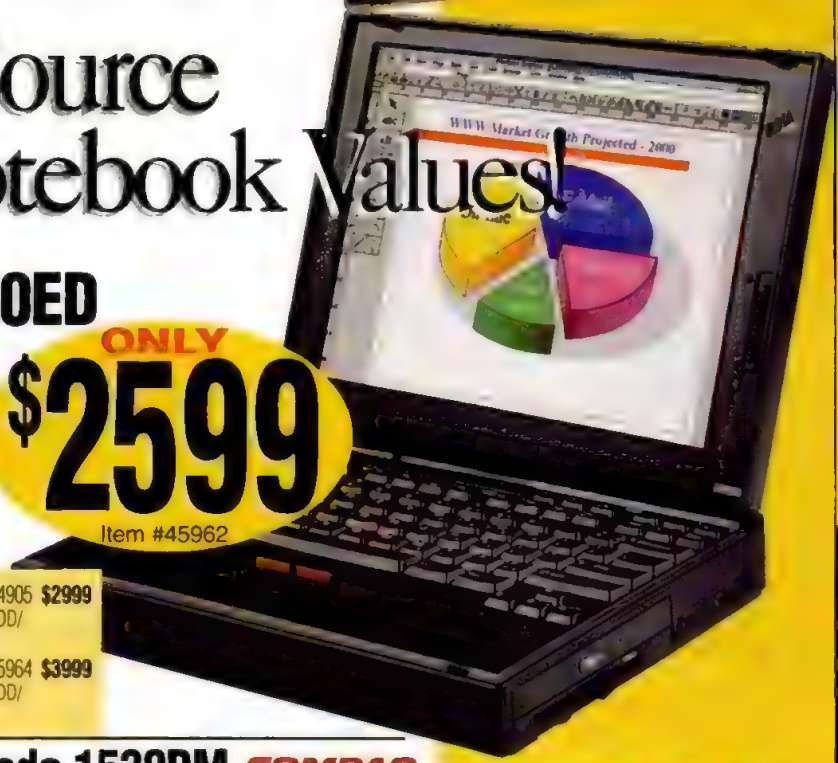

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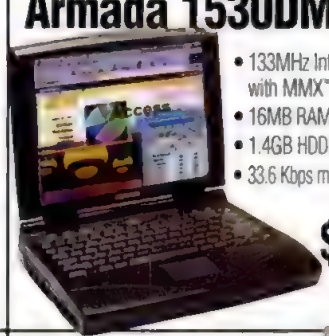

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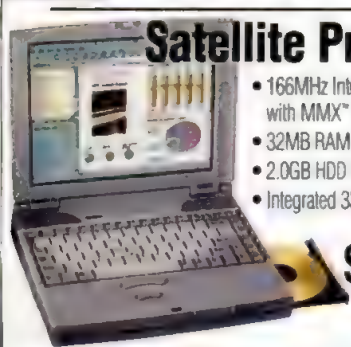

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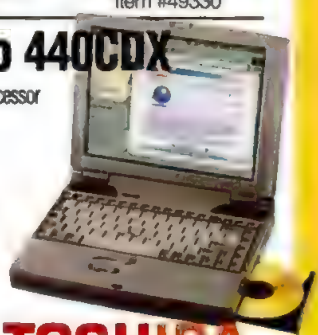

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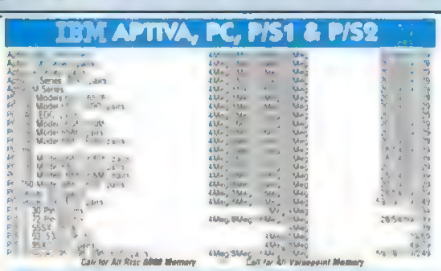

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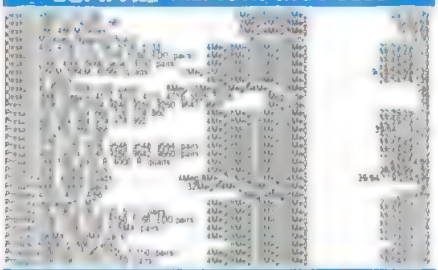

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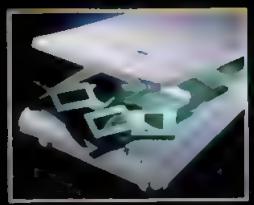

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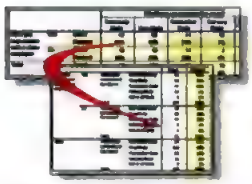

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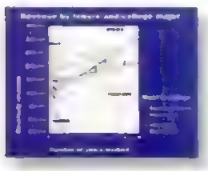

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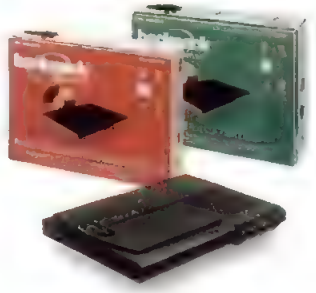

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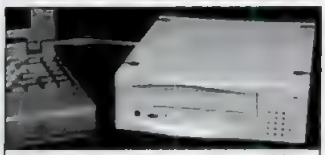

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4000MB	5200	Western Digital	AC34000	$243
4000MB	**5200**	**Micropolis**	**MC4540A**	**$225**
4320MB	4480	Maxtor	M84320A	$258
4320MB	3600	Quantum	BF4335A	$211
5000MB	**5200**	**Micropolis**	**MC4550A**	**$275**
5120MB	5400	Maxtor	M85120A	$318
6450MB	5400	Seagate	ST36450A	$341
6510MB	3600	Quantum	BF6510A	$311

ULTRA IDE HARD DRIVES

Promise PCI Ultra IDE Controller ULTRA33 with drive **$99**

1614MB	5400	Quantum	FB31620A	$149
1750MB	5400	Fujitsu	MPJ3017U	$152
2111MB	4500	Seagate	ST32122A	$169
2151MB	5400	Quantum	FB32160A	$181
2620MB	5400	Fujitsu	MPJ3026U	$178
2727MB	4500	Seagate	ST33232A	$199
3228MB	5400	Quantum	FB33240A	$212
3500MB	5400	Fujitsu	MPJ3035U	$198
4303MB	4500	Seagate	ST34342A	$244
4304MB	5400	Western Digital	AC34300	$244
4310MB	5400	Quantum	FB34320A	$249
4350MB	5400	Fujitsu	MPJ3043U	$259
5160MB	5400	Western Digital	AC35100	$355
5250MB	5400	Fujitsu	MPJ3052U	$309
6400MB	5400	Western Digital	AC36400	$388
6448MB	5400	Quantum	FB364480A	$346
7000MB	5200	Maxtor	M87000D	$365

SCSI HARD DRIVES

Add a DPT 2044UB Ultra SCSI controller $199

SCSI	RPM	Brand	Model	Price
2150MB	5400	Seagate	ST32160N	$225
2151MB	5400	Quantum	FB32160N	$225
2160MB	7200	Seagate	ST32272N	$369
2275MB	7200	Quantum	VK32275S	$339
3228MB	5400	Quantum	FB32240S	$289
4300MB	5400	Micropolis	MC4743	$319
4310MB	5400	Quantum	FB34320S	$319
4400MB	7200	Fujitsu	M2954S	$539
4550MB	7200	Micropolis	MC4345	$519
4550MB	7200	Micropolis	MC4345AV	$595
4550MB	7200	Seagate	ST34572N	$579
4550MB	7200	Quantum	VK34550S	$509
4550MB	7200	Quantum	XP34550S	$609
4550MB	10,000	Seagate	ST34501N	$669
6448MB	5400	Quantum	FB36480S	$439
9100MB	**7200**	**Micropolis**	**MC3391**	**$869**
9100MB	7200	Fujitsu	M2949S	$895
9100MB	7200	Quantum	XP39100S	$915
9100MB	7200	Micropolis	MC3391AV	$999
9100MB	7200	Seagate	ST19171N	$939
9100MB	10,000	Seagate	ST19101N	$1079
23300MB	5400	Seagate	ST423451N	$1799

WIDE HARD DRIVES

Add a DPT 2044UWB Ultra Wide SCSI controller for $249

WIDE	RPM	Brand	Model	Price
2160MB	7200	Seagate	ST32272W	$409
2275MB	7200	Quantum	VK32275W	$339
4300MB	**5400**	**Micropolis**	**MC4743W**	**$335**
4400MB	7200	Fujitsu	M2954W	$550
4550MB	7200	Micropolis	MC4345W	$545
4550MB	7200	Micropolis	MC4345WAV	$619
4550MB	7200	Seagate	ST34572W	$599
4550MB	7200	Quantum	VK34550W	$509
4550MB	7200	Quantum	XP34550W	$609
4550MB	10000	Seagate	ST34501W	$719
9091MB	**5400**	**Micropolis**	**MC3391W**	**$909**
9091MB	5400	Micropolis	MC3391WAV	$1029
9100MB	7200	Fujitsu	M2949W	$960
9100MB	7200	Quantum	XP39100W	$919
9100MB	7200	Seagate	ST19171W	$939
9100MB	10,000	Seagate	ST19101W	$1109
23300MB	5400	Seagate	ST423451W	$1829

CD ROM DRIVES

IDE CD ROM

Speed	Brand	Model	ms	Int
16X	NEC	CDR1600	100	$85
16X	Toshiba	XM6201B	90	$87
24X	Teac	CD524E	85	$95
24X	Panasonic	CR585	85	$99
24X	Mitsumi	CRMCFX24X	90	$102
24X	Toshiba	XM6101B	85	$103
32X	Teac	CD532E	85	$115

IDE CD CHANGERS

Speed	Brand	Model	# Disks	Int
6X	NEC	CDR4X6	4	$79
8X	NEC	CDR4X8	4	$105
12X	Panasonic	SQTC512N	5	$266

ACCESSORIES

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Creative Labs Sound Blaster AWE64 (SB64AWEGOLD) $180
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25 Watt (SPEAKER.R) $99 35 Watt (SPEAKERPRO) $129
Universal sound cable(AUDIOMIX) $10
Turn any IDE CD ROM into an external for parallel printer port (PPCASECD) $89
Turn any IDE CD ROM into an external for PCMCIA port (PCMCIACASECD) $189

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Speed	Brand	Model	ms	Int
12X	Plextor	PX12TS(tray)	105	$197
12X	Plextor	PX12CS(caddy)	105	$259
15X	Toshiba	XM3801B	99	$145
16X	NEC	CDR1610	100	$135
20X	Plextor	PX20TS	95	$225
24X	NEC	CDR1810	85	$159

SCSI CD CHANGERS

Speed	Brand	Model	# Drsks	
16X	Nakamichi	MJS16	5	$239

SCSI CD TOWERS		4 Drive	7 Drive
15X	Toshiba	99ms	$819	$1439
16X	NEC	100ms	$859	$1499
20X	Plextor	95ms	$1259	$2249

SCSI CD TOWERS w/ 5 Disc Changers
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2x6 Internal SCSI drive (CDU926S) $309*
2x8 Internal IDE (CDU928S) $349*
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Yamaha 4x6
Internal SCSI drive tray load (YCDR400T) $469*
Internal SCSI drive caddy load (YCDR400) $479*
Internal IDE drive tray load (YCDR400A) $479*
NEW IDE ReWritable (YCDRW4001T) $639*

Teac 4X12
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Ricoh 2x6 CD ReWritable
Internal SCSI drive 1MB, tray load (RO6200S) $419*
Internal SCSI drive 2MB, caddy load (RO6201S) $469*

JVC 2x6
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Hewlett Packard SureStor 6020i
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Mitsumi 2x6
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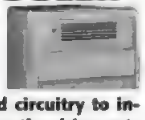
Internal (CRMC2600TE) $415
*Drive must be purchased with CDR software or media

DRIVE COOLER



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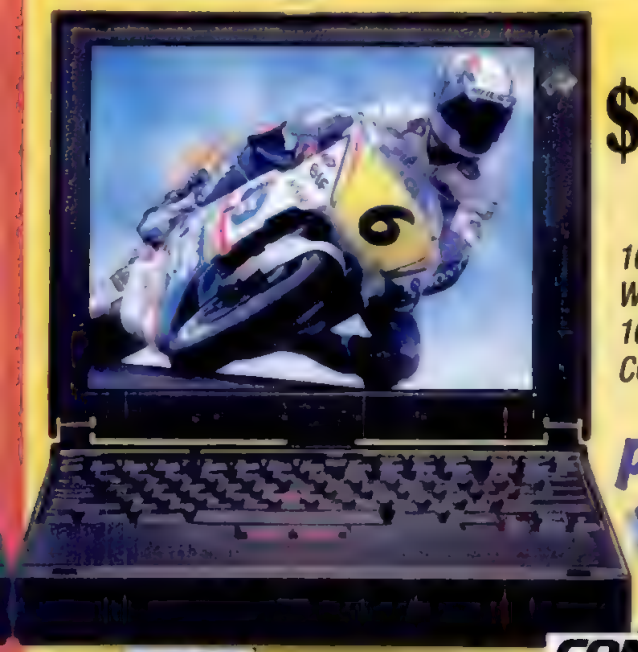

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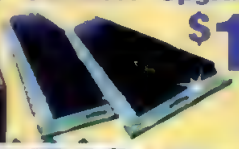

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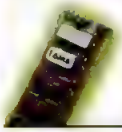

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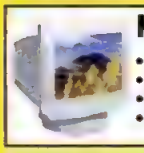

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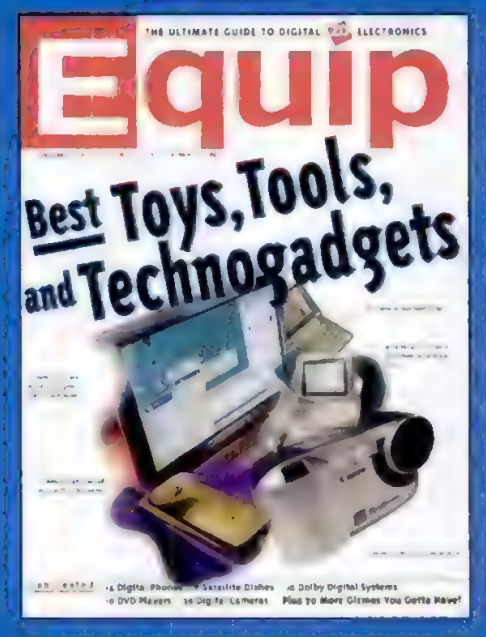

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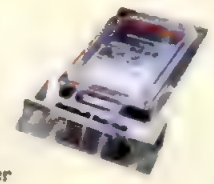

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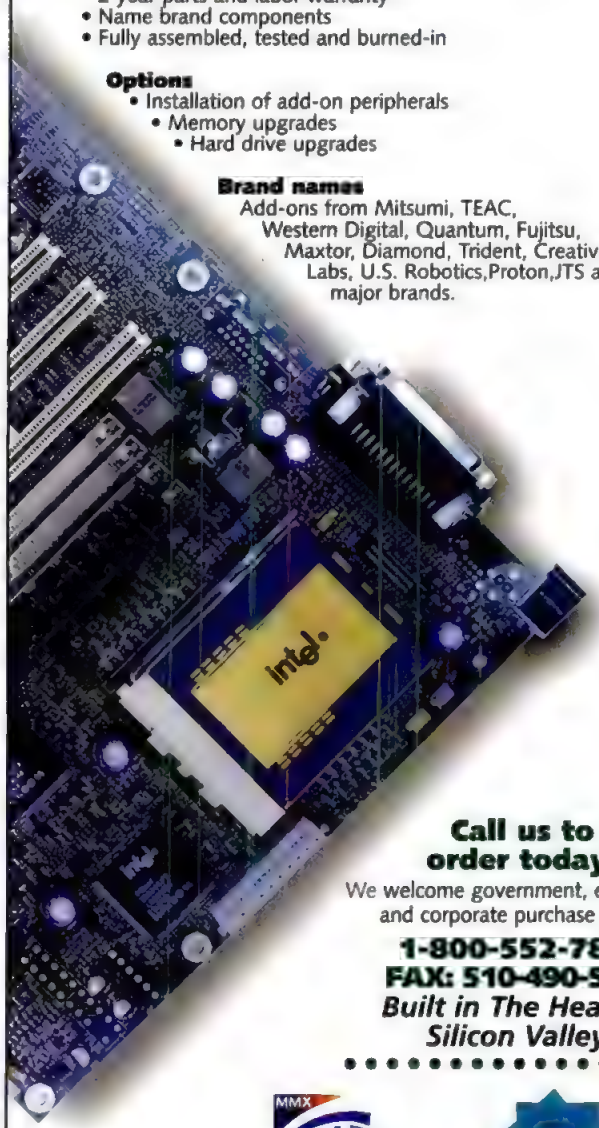

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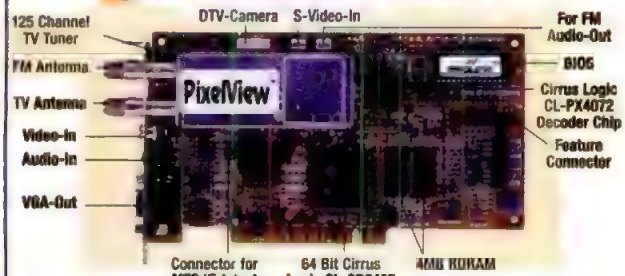

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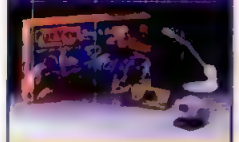

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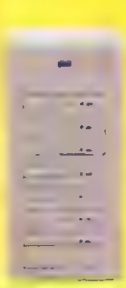

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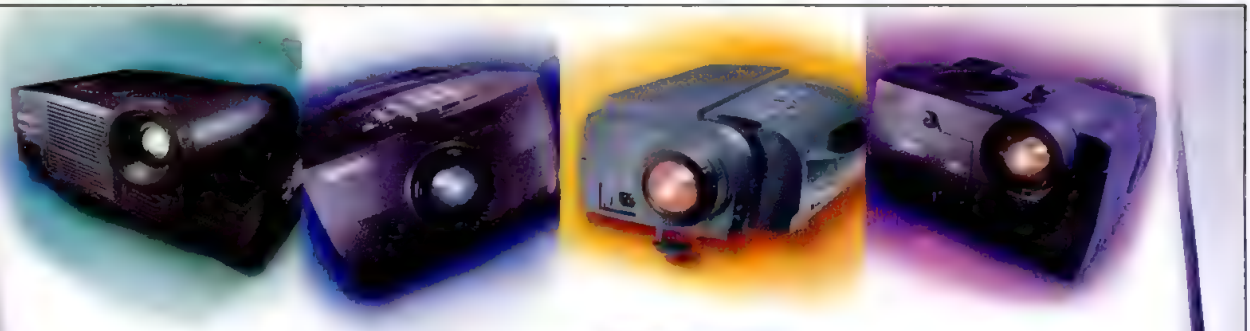

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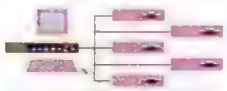

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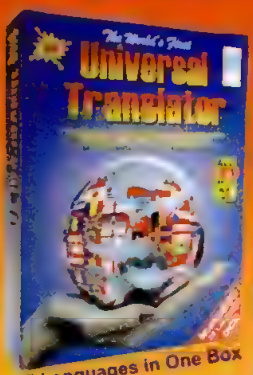

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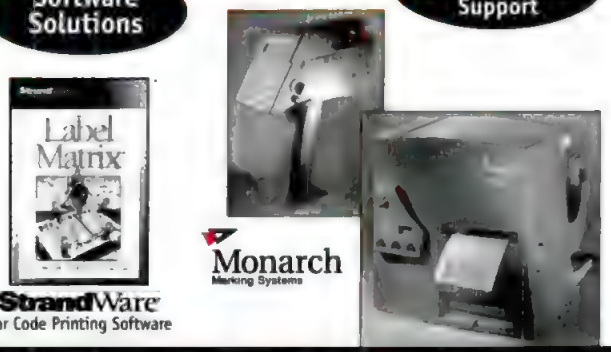

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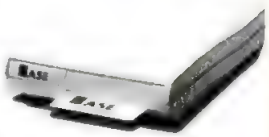

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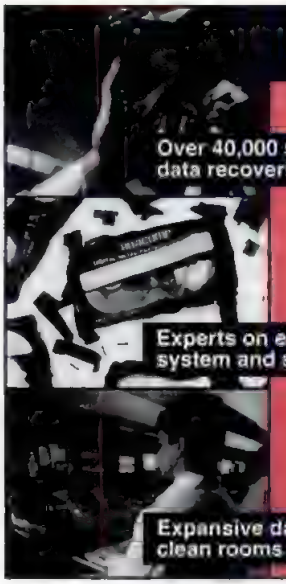

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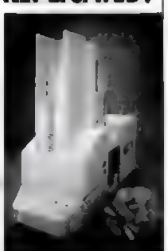

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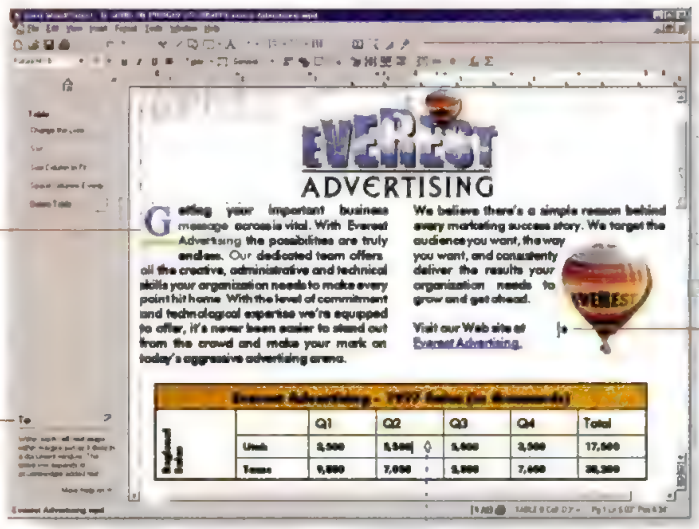

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After Hours

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Need a game controller for under $100? You'll find some excellent options here.

A decent joystick is a good purchase for any home PC; a quality one is important for playing games, and a great one is required for flight sims. We looked at eight recently released joysticks that work with Windows 95 games and cost from $35 to $100. Though all of them are solid, Logitech's Wingman Extreme Digital and Microsoft's SideWinder Precision Pro stand out as our Editors' Choice selections.

Unfortunately, all of the joysticks reviewed here are designed for right-handed players. If you're left-handed and need a reliable joystick, we suggest CH Products' venerable Flightstick Pro ($50 street; CH Products, 800-624-5804)—simply one of the best joysticks ever made—or the Microsoft SideWinder 3D Pro ($40 street; Microsoft Corp., 800-426-9400).

CH Products Jane's Combat Stick

Over the past few years, some of the most realistic simulations have come from Jane's Combat Simulations (an Origin Systems/Electronic Arts label), so it makes sense that this brand should produce a realistic flight stick. Unfortunately, Jane's Combat Stick (JCS) is decidedly average when compared with the others in this roundup.

JCS is basically a CH Products F-16 Combat Stick customized to work well with Jane's games. A copy of Advanced Tactical Fighters—a Jane's simulation—comes bundled with JCS.

JCS is a medium-size stick, roughly the same size as the Gravis Firebird 2 and the Microsoft Precision Pro. Still, players with small hands may want to look elsewhere. The handle has six buttons and two hat switches; the stick also comes with yoke and throttle controls on the base.

The stick offers less tension than others reviewed here, and we often found ourselves flying all over the place and out of control during games. On the other hand, installation was easy, and the required software came on the included game CD-ROM.

This is also the most expensive stick in the roundup. If you won't be happy unless you feel as if you're really flying an F-16, this may be the stick for you. Otherwise, you'll probably want to check out the Logitech and Microsoft sticks.
—*Shane Mooney*

Gravis Blackhawk

While a multitude of buttons and features appeals to some game players' innate need for bigger and better toys, most of us would be happy with something simpler. That's where the Gravis Blackhawk comes in.

The Blackhawk is no larger in diameter then a mouse pad, so it can fit easily next to the keyboard on most desktops. And the compact design comes without a sacrifice in usability.

The joystick's handle is ergonomically shaped to feel comfortable in your hand, which is great if you like to spend hours playing Quake. There are three buttons on the handle and one on the base, but the latter button is a bit out of the way. We found ourselves having to look down a lot to find it.

The Blackhawk is easy to install: You simply turn your PC off, plug the stick into the game port, and turn the PC back on. Windows 95 automatically recognizes the stick, so all that's left to do is to calibrate it.

The only major drawback of the Blackhawk is its lack of a hat switch, a deficiency that looms large for flight-sim fans. But for action games and even some science-fiction games, the Blackhawk has a lot going for it. Given its street price of about $30 or less, we believe that many game fans will accept the Blackhawk even without the hat switch—especially if their tastes tend toward such titles as MDK and Duke Nukem 3D.—*SM*

INSIDE

KING OF THE HILL
A classic game returns in its best installment.
Page 376.

ACES HIGH
EF2000 V2.0 arrives with a host of improvements over the original.
Page 376.

After Hours

FIREBIRD 2
★★★½☆ $69.95 list, Gravis, 800-663-8558, www.gravis.com

Gravis Firebird 2

If you're the kind of player who needs all the coolest toys he can get, Gravis has the joystick for you. Descended from the many-buttoned Phoenix and its little brother, the Firebird, the Firebird 2 is an ergonomically designed, programmable joystick.

The Firebird 2 boasts 13 buttons and an eight-way directional hat switch. The joystick is housed in a larger-than-average base; we had to clear off a big chunk of desktop real estate for it. We suppose the Firebird 2 has to be big because it can store so much data: You can assign up to 106 keystrokes, distributed among the stick's buttons. This feature lets you program entire strings of keyboard input—such as a cheat code—which are then activated by a single button.

The Firebird 2's handgrip is comfortable and comes with a hand rest for prolonged use. Turn the stick over and you'll find that the base has four sliders, used to adjust the tension for each of the joystick's directional axes.

Installation is the one area where the Firebird 2 falls flat. First you have to power down the computer and plug the stick into the game and keyboard ports. Then you plug the keyboard into the Firebird 2's pass-through socket. Finally, you have to install the software. Fortunately, the software is intuitive and simple to install, but we feel that with the advent of digital joysticks, keyboard pass-through sockets should be a thing of the past.

While this joystick definitely isn't for everyone, those longing to have lengthy keyboard commands a mere button-press away will want to get their hands on it.—*SM*

Logitech Wingman Extreme Digital

PC MAGAZINE EDITORS' CHOICE

When the Wingman Extreme first hit the scene a few years ago, it was considered by many game fans to be the perfect joystick. A nicely sculpted grip and a balanced feel made the stick suitable for action games and flight simulations alike. So how does Logitech improve on such a product? By making it digital.

WINGMAN EXTREME DIGITAL
★★★★★ $49.95 list, Logitech, 800-231-7717, www.logitech.com

Much of the digital-over-analog debate may sound like hype, but the fact is that digital joysticks are typically much more responsive and accurate than their analog counterparts. Also, you can program most digital sticks to emulate keyboard input without having to connect them to the keyboard port (as you must with the Gravis Firebird 2).

But all of this technical mumbo jumbo aside, how does the joystick feel? The Wingman Extreme Digital is one of the most comfortable sticks we've used (provided that you're right-handed). The Wingman has a hat switch and six rubber-coated buttons. The buttons are great, because the rubber coating keeps your sweat-soaked fingers from sliding off in the heat of battle.

Installation is quick and painless, and the included software makes the stick very easy to program. What we like best about the Wingman, however, is the tension in its handgrip. Though this amount of tension may prove too high for action fans, we found it added a feeling of realism to flight games.

All in all, we were very impressed with the Wingman. Logitech took a good stick and made it even better. This joystick is all about balance: balance in its features, balance in its feel, and perhaps best of all, a nice big balance left over in your bank account.—*SM*

Microsoft SideWinder Precision Pro

PC MAGAZINE EDITORS' CHOICE

Microsoft surprised more than few people when it introduced the SideWinder 3D Pro joystick last year. The 3D Pro turned out to be a much better and more reliable joystick than most critics (including us) expected. In fact, the 3D Pro is so good and so popular that it will be a tough act to follow. But enter the SideWinder Precision Pro—a newly designed variant of the 3D Pro that looks and feels even better than its predecessor.

SIDEWINDER PRECISION PRO
★★★★★ $69.95 list, Microsoft Corp., 800-426-9400, www.microsoft.com

The most obvious change in the Precision Pro is the ergonomic handgrip. This makes the stick much more comfortable for right-handers. The Precision Pro has four buttons and a hat switch on the handgrip, along with four additional buttons on the base. There's also a rotary-dial throttle control (which is a bit better than the 3D Pro's slider throttle) and a shift button that lets you access a secondary game action for each button.

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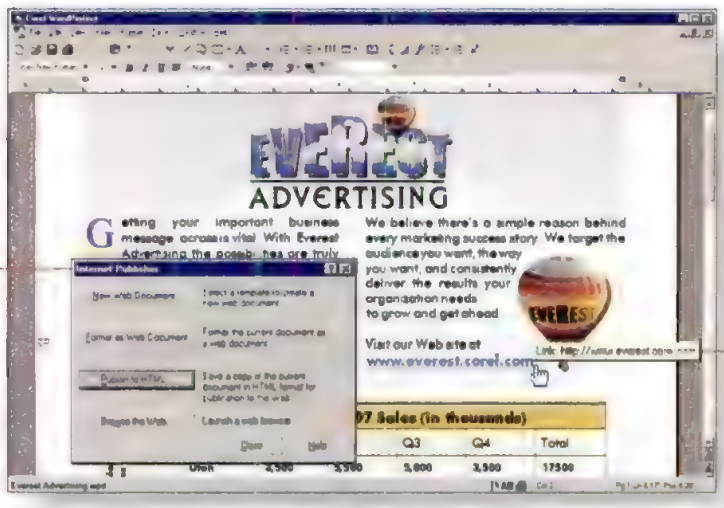

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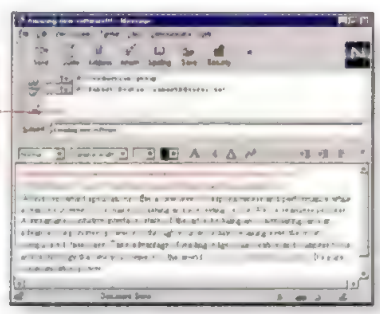

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F-15E TALON
★★★★½ $59 list. Suncom, 847-228-6002, www.suncom.com.

Last, the Precision Pro includes a rotating handgrip. Depending on the game you're playing, you can use this feature to change your point of view, move your rudder, aim weapons, or strafe from side to side.

Like Logitech's Wingman Extreme Digital, the Precision Pro is digital and provides high performance and programmability. The joystick is easy to install, and its software practically installs itself. The Precision Pro comes with the SideWinder profile editor, which lets you create personalized settings for your favorite games.

The Precision Pro works well with all types of games. Some players may find the stick's base too big, and flight simulation fanatics may opt for one that feels more realistic, but the Microsoft SideWinder Precision Pro is a great product and should meet most users' gaming needs.—*SM and Michael E. Ryan*

Suncom F-15E Talon

Hard-core flight-simulation fans used to dismiss Suncom as a producer of cheap joysticks that retailed for $10 and broke in 10 minutes. No longer. Over the past few years, Suncom has gone after the flight-sim crowd with durable, programmable sticks at reasonable prices. The company weathered a patent-infringement lawsuit from Thrustmaster based on the technology in these sticks, and it now stands poised to capture the middle ground of the market.

The innovative F-15E Talon represents the high end of a trio of flight joysticks based on the control stick found in F-15E Eagle aircraft. Installation is simple, with a standard 15-pin connector and both AT and PS/2 keyboard pass-throughs. The Talon is unique in that it allows you to assign any keystroke to any button without the use of special software. This means that you can assign keystrokes to buttons during game play, and the stick remembers the key assignments even after it's turned off. You simply hit a switch to enable keyboard emulation mode, select a button, and assign a key.

The Talon is well made and responsive, with four fire buttons and two four-way hat switches. The buttons are too hard, though, with sharp edges that might cause some discomfort. The wide grip and spread of the buttons also may make the stick tough on small hands. Suction cups keep it place during heavy use, and the base is adequately weighted. The action feels a little loose compared with the tight action of the Thrustmaster sticks, but this is a matter of personal taste.

The fact remains that a flight stick this well designed and with such a novel method of programming is a rare find in the medium price range.
—*T. Liam McDonald*

Thrustmaster X-Fighter

If you've always wanted a Thrustmaster-quality joystick but were unwilling to shell out $150 to $200, there are now two alternatives. Thrustmaster has taken the basic design of its high-end Pro Flight Control System (PFCS), which retails for $150, and used it for its X-Fighter and Top Gun sticks.

Like the PFCS, the X-Fighter is styled on the B-8 grip designed for use in A-10 aircraft and other military jets. The joystick features a four-way hat switch, an index trigger, a pinkie button, and two additional thumb buttons. The buttons have smooth action, while the hat switch floats comfortably under the thumb.

X-FIGHTER
★★★½ $59 list. Thrustmaster Inc., 503-615-3200, www.thrustmaster.com.

The neoprene grips are cross-hatched to reduce slippage in sweaty palms, and a hand rest makes it easy to maintain a grip. The stick itself is designed to be comfortable in large hands. (People with smaller hands are better off with the Top Gun.)

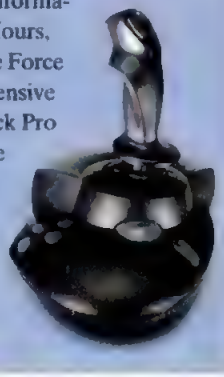
The X-Fighter's weighted base is wide and has good traction to keep it from sliding

Need Feedback?

If you like to feel a bit more involved in your games, take a look at Microsoft's **SideWinder Force Feedback Pro** ($150 street; Microsoft Corp., 800-426-9400, *www.microsoft.com*).

This joystick is based on the same design as the SideWinder Precision Pro but uses force-feedback technology to respond physically to input from software. This means that the joystick shakes and jumps when you perform certain actions (such as firing a machine gun) in games that support the technology.

The only other force-feedback joystick currently on the market is CH Products' Force FX (for more information, see "The Feel of Control" in After Hours, *PC Magazine*, April 8, 1997). We liked the Force FX but felt that it was too big and too expensive ($249 list). By contrast, the Force Feedback Pro delivers all the tactile benefits of the Force FX in a smaller, more ergonomic package and at a lower price. Additionally, the Microsoft stick allows you to adjust the degree of feedback through its calibration applet. Not a bad package, if you're into funky toys.—*MER*



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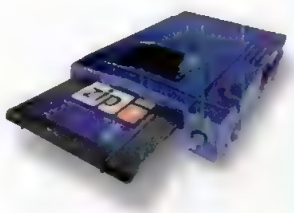

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around. A 7-foot cable is tipped with a 15-pin connector and needs no keyboard pass-through. There is no software installation, because the X-Fighter can't be programmed on its own, a fact that brought the stick's score down. In Windows 95, you configure the stick as a standard Thrustmaster Flight Control System. When used with the Thrustmaster Weapons Control System II throttle control, the hat switch and four buttons on the X-Fighter can be programmed.

The action on the X-Fighter is satisfyingly stiff, which prevents oversteering in flight and driving games. In more frenzied action games, though, this stiffness can quickly cause a strained wrist, which makes the X-Fighter a better choice for introductory-to-midlevel flight-simulation enthusiasts. In general, this is a well-built, durable, smoothly designed joystick with a reasonable price.—*TLM*

TOP GUN
★★★½ $49 list, Thrustmaster Inc., 503-615-3200, www.thrustmaster.com.

Thrustmaster Top Gun

The Thrustmaster Top Gun is essentially a scaled-down version of the X-Fighter joystick, which in turn is a simpler version of the PFCS. Which is right for you depends on your personal tastes—and the size of your hands.

The Top Gun is based on the same B-8 grip as the X-Fighter, but it's about a third smaller. The Top Gun is a lighter and less sturdy stick, designed for people with medium-size or small hands. Its action is far less stiff than the X-Fighter—and this feature, coupled with the smaller size, makes Top Gun a good choice for kids. Three small buttons, a trigger button, and a floating hat switch are all placed so that people with shorter fingers can reach them without straining. None of these buttons have native programmability, but they can all be programmed if used in conjunction with the Thrustmaster WCS II throttle.

Installation is fairly easy. A single 15-pin connector screws into the game port. There are no software or drivers needed, and Windows 95 installation uses the standard Thrustmaster configuration. Games that have native Thrustmaster support will enable all buttons on the stick exactly as they would with the Thrustmaster Flight Control System.

The lighter weight and narrower footprint of the base give the whole joystick a less impressive feel than that of its bigger brothers. The rubber table grips on the base are also smaller and don't do a good job of keeping the Top Gun in one place during use. But with its reasonable price and impressive feel, the Top Gun is a good choice for people who have trouble wrapping their hands around the bigger sticks.—*TLM*

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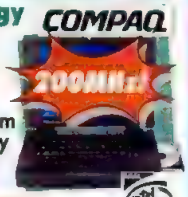

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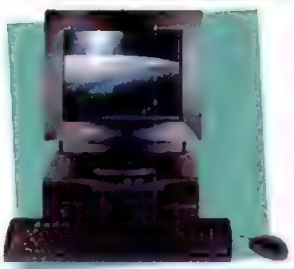

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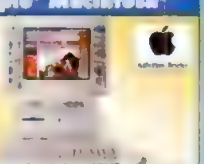

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A Return to Power

A classic fantasy/strategy series makes an impressive comeback.

Warlords III: Reign of Heroes

Before Heroes of Might and Magic, there was Warlords, one of the unquestionable classics of computer gaming. The game's blend of straightforward conquest and fantasy role-playing has hooked game players throughout its several incarnations, and now the game makes its way to Windows 95 in the form of Warlords III.

As with any update of a beloved classic, the first thing you'll notice about Warlords III is improved graphics. The finely textured maps and evocative illustrations of characters and buildings provide an ideal playing environment. Tacky video clips should have been left on the editing-room floor, but the rest of the production is first-rate, and none of it will strain your system. The game ran perfectly on a low-end Pentium with Windows 95 and 16MB of RAM.

Game play follows a familiar pattern: You build units, group them together under the leadership of a "hero," then go forth to conquer cities and explore exotic ruins. Play is turn-based, and combat results are tallied instantly based on factors like unit strength, morale, and various leadership benefits. Heroes can raid locations to find magical items that will give them and their armies an edge in battle.

Warlords III features 12 scenarios and 1 campaign, but a random map and battle generator allows for almost unlimited gaming. There is, unfortunately, no scenario editor.

The artificial intelligence of the game is outstanding. Enemies are aggressive, and their strategies often surprise you. The diplomatic model is more complex, allowing for alliances and bribes, but other leaders turn on you as you get more successful. In case an artificial opponent isn't exciting enough for you, there is absolutely terrific online support for up to eight players. Simultaneous movement keeps the action lively, and the native LAN, TCP/IP, and modem support is smooth.

Warlords III is one of those timeless games you can learn in a few minutes and just keep playing and playing.—*TLM*

Air Superiority

A host of graphics and game-play improvements make a good game great.

EF2000 V2.0

EF2000 hit hard disks two years ago and, with its realism and graphics, set flight simulation on its ear. Despite some problems with stability, artificial intelligence, and game-play bugs, this title became a favorite through diligent patching and the creation of add-on modules that improved and expanded the game. Now all of these modules and patches are available in the new version, EF2000 V2.0, and create a near-perfect flight simulation.

EF2000 V2.0 adds substantially to the original package, with its GraphicsPlus add-on, the Tactical Mission Planner, expanded multiplayer capabilities, native Windows 95 play, and other embellishments. The minimum system requirement is a Pentium/75 with 16MB of RAM, but you really need at least a Pentium/120 for the best performance. A Rendition or a 3Dfx 3-D accelerator card is optional, but when you use one, the graphics really soar. Both the Windows 95 and DOS versions are included, but the 3-D enhanced versions are DOS-only.

EF2000 offers a simulation of the EuroFighter 2000. Standalone missions help you get acquainted with the game's weapons and tactics, but its heart is a complex campaign section. With the addition of the Tactical Mission Planner, you can now control all aspects of a truly dynamic battlefield, setting targets and strike packages and then flying missions. This level of control makes EF2000 one of the most complex and satisfying flight campaigns ever created.

The flight model itself is cutting-edge, with a realistic feel that places it solidly in the upper tier. It's a pretty tough bird to fly, but it rewards patience with some extraordinary game play.

Eight-player LAN and Internet play, improved stability and artificial intelligence, a custom dogfight creator, and numerous other features substantially improve on and enhance the original. There is no question that EF2000 V2.0 now stands as one of the best hard-core flight simulators on the market.—*TLM*

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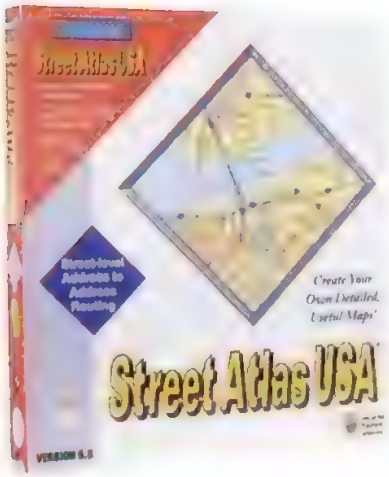

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Editing and retouching	Good	Excellent	Good	Good	Fair	Fair	Good
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Coming Up

What's in the Next Issue of *PC Magazine*

PC Lines

It's time for our annual blockbuster roundup of the latest lines that PC vendors are offering. In total, we test more than 100 systems, broken out into looks at PCs for the corporate desktop, professional workstations, and home units.

Graphics Adapters

Are you thinking of buying a new graphics adapter for 2-D and 3-D acceleration? Sure, most applications that use 3-D right now are games, but that will change quickly over the next year or two as business apps build in 3-D functionality for advanced features—and you'll need the hardware to run them. We review 25 boards, with prices tags of $300 or less.

Web Search Sites

Here's your complete guide to finding everything that finds everything online. We're putting together a roundup of search sites, metasearch sites, white pages, and more. PC Magazine Labs has put all of these sites through some rigorous search tests. We tell you which sites are best for searching for what.

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PC Magazine, (ISSN 0888-8507, is published twice a month except in July and August, at $49.97 for one year. Ziff-Davis Inc., One Park Ave., New York, NY 10016-5802. Periodicals postage paid at New York, NY 10016-5802 and at additional mailing offices. POSTMASTER: Address changes to *PC Magazine*, P.O. Box 54093, Boulder, CO 80328-4093. The Canadian GST registration number is 14049 6720 RT. Canada Post International Publications Mail Product (Canadian Distribution) Sales Agreement No. 266477. Printed in the U.S.A.

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Complete Tiger Systems With Ultra DMA Hard Disks, Intel AGP Video, and More!

Tiger Builds Great Systems! In A Recent Review Of K-6 Systems...

"The Tiger K6 233 was this roundup's leading performer..."
"...its Business Winstone score led the pack."
"...its MMX numbers were unmatched." –PC Magazine

QUALITY COMPONENTS

Xpression 3D Video*

BOCA Research 56K Voice/FaxModem

YAMAHA Digital Speakers

Microsoft IntelliMouse

*Pentium II has ATI 3D RAGE PRO AGP video. All OEM packaged without retail box.

9-Bay Case! Side panels provide easy access without removing rear cables. Also includes third fan in front of case!

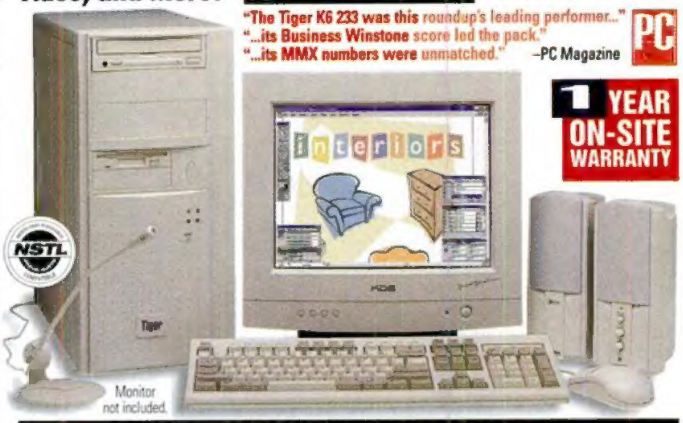
Tiger builds winning systems for hundreds less! We use top-quality components like ATI, BOCA, and Microsoft, and deliver state-of-the-art technology like Ultra DMA/33 hard disks and AGP video—the fastest you can find. We back it up with a full one-year, on-site warranty that comes to you when needed, and we do it all for less—up to $1,000 less! That's why you should buy your next computer from Tiger. It's no wonder Tiger is rapidly becoming such a popular brand in America!

Four top-of-the-line MMX systems to choose from: the AMD-K6 MMX 233MHz, IBM's 6x86MX PR233, Intel's Pentium MMX 233MHz, or the incredible Pentium II 266MHz. These complete systems are ready to run right out of the box—instantly surfing the Internet, enjoying the latest multimedia CD-ROMs and zipping through the most complex graphics applications. You can't beat the price and performance of these multimedia systems from Tiger! You get an incredibly rich multimedia experience with these MMX-enabled processors—up to twice the multimedia performance with MMX applications!

All of these complete systems include a huge 4.3GB hard drive, the fastest 24X CD-ROM drive, 32MBs of the fastest SDRAM memory, 16-bit SoundBlaster Pro-compatible sound with 3D effects and wave table audio, BOCA 56K faxmodem with voice capability, ATI 3D video for stunning graphics and heart-pounding 3D games, Yamaha digital stereo speakers, Microsoft IntelliMouse and more. Everything you need for an incredible multimedia PC that will take you into the next millennium in style.

Tiger systems feature the most advanced 64-bit ATX motherboards. Want the fastest hard disk transfer speeds? Then you must have the Ultra DMA-supporting chipsets on these motherboards. The new Ultra DMA/33 bursts hard disk data at an astounding 33MB/second. Twice the speed of the previous 16MB/second mode! And we teamed it up with a huge 4.3 GB Ultra DMA/33 hard disk—amazingly fast and outrageously large!

Tiger's Pentium II motherboard even includes the latest video breakthrough—AGP! (Accelerated Graphics Port) This new type of expansion slot makes AGP video run 10 times faster than PCI!



1 YEAR ON-SITE WARRANTY

All Tiger MMX Multimedia Systems Include:

- 4.3 GB Ultra DMA/33 Hard Disk
- 32MB High-speed SDRAM
- ATI Xpression 3D Video with 4MB (Pentium II has ATI 3D RAGE PRO AGP)
- 24X CD-ROM Drive
- BOCA 56K Faxmodem with Voice
- 16-Bit 3D Wave Table Sound
- Yamaha Speakers and Boom Microphone
- Microsoft IntelliMouse
- Premium Windows 95 Keyboard
- Windows 95 Release 2 Pre-loaded
- One-Year On-Site Warranty

With the included ATI 3D RAGE PRO AGP-powered video adapter, it's perfect recording live video,3D games, and more!

Tiger systems come with all the multimedia extras you'd expect on a state-of-the-art system from Tiger. We'll even custom build a system just for you! Call now for up-to-the-minute prices and features.

Item #	Processor	Price
A13-S2 1	IBM 6x86MX PR233	$1,249.99
A13-S2 2	AMD-K6 233 MMX	$1,299.99
A13-S2 3	Pentium MMX 233	$1,399.99
A13-S2 4	Pentium II MMX 266	$1,799.99

As prices are always changing on CPUs, we do not offer price protection in the event prices rise or fall. Call for warranty information.

Ready-To-Run IBM 6x86 PR200 System: JUST $699.99

Loaded System With 1.7 GB Hard Disk, 3D Video, 4-CD Changer, More!

Only Tiger could bring you this high-performance computer at such an incredibly low price! It seems only a few months ago this very machine was selling for over $2,000—rated by PC Magazine as the world's fastest processor! But thanks to stiff competition in the processor market and Tiger's compelling pricing policies, this fully-loaded system is yours for the unbelievably low price of just $699! Just add a monitor and you're ready to run a complete multimedia 200!

IBM MEANS: COMPLETE COMPATIBILITY

Is it fast? You bet... benchmarked proven to be faster than the Pentium 200MHz. We loaded it with all the right components and the latest multimedia goodies to make this the perfect system for both home entertainment and office productivity. The 1.7 GB hard disk gives you plenty of room for both work and play. On the work side, you'll keep abreast of up-to-the-minute news with the Internet-ready 33.6K faxmodem. On the play side, the S3 ViRGE 64-bit PCI graphics adapter includes 3D processing for amazing games with stunning graphics. Direct3D-compatible for the latest 3D games. Everyone loves the convenience of the NEC CDROM drive—holds four CDs! No more fumbling with CD jewel cases or error messages about dirty CDs with fingerprints—slip in your favorite four and forget about them. They'll always be ready. Perfect for CD backups, libraries, and all types of CD references.

We put all these great components in out best case, featuring 9 bays for plenty of future expansion and a reliable 200-watt power supply for power to spare. (Some name-brands only include a 65-watt power supply!) This good-looking, yet rugged, mid-tower case also has Tiger's unique Triple-Fan Cooling System. Besides the processor and power supply fans, we added an extra fan in the front of the case to keep everything running cool. In fact, should the processor fan ever go out for whatever reason, the front case fan will continue to keep it running cool and trouble-free. And when you need to access the insides of this case, you'll appreciate the removable side panels. No need to remove rear cables.

This is the right system at the right time. Do the math—why pay double the price for only half the increase in performance? The IBM 6x86 PR200 has plenty of horsepower, and this system includes all the right multimedia extras for a great home entertainment or office business PC.

Hurry—limited supplies won't last!

"The 6x86 outperforms Intel's fastest mainstream chip..." — PC Magazine

PC MAGAZINE EDITORS' CHOICE

S3 ViRGE 3D Video With Direct3D!

INTERNET READY . . .

X86 PROCESSOR Manufactured by IBM

IBM 6x86™ PR200+ Multimedia System

- IBM 6x86 PR200+ Processor
- 16 MB High-speed EDO RAM
- 1.7 GB EIDE Hard Disk
- S3 ViRGE PCI Video with 3D
- 2 MB Video Memory (Upgradable to 4 MB)
- 33.6K Faxmodem
- NEC Four-CD 6X CD-ROM Changer
- 200-Watt Case with Triple Cooling Fans
- 16-Bit 3D Audio with Wave Table
- Stereo Speakers and Boom Microphone
- Premium Win95 Keyboard and PS/2 Mouse
- Windows 95 Pre-loaded
- 1 Year Depot Warranty

A13-S1 4 ..... $699.99

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A126-1024 A5SE $119.99

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- Windows 95
- Excel 97
- Word 97
- PowerPoint 97
- Access 97
- Outlook 97

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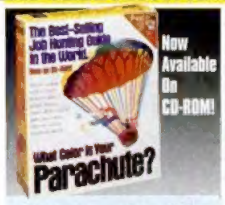

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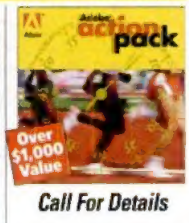

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Every day we visit Random House's Web site (*www.randomhouse.com*) to read Jesse's Word of the Day, in which word maven Jesse Sheidlower tells great stories about how particular words came to be. But as we browsed around the site's book promotions recently, we were even more intrigued by one especially exciting new title for the fall season. "Sex on Campus: Get it now, for 20% off."

☞ Such a deal! (OfficeMax brochure.)

Teach Your Children Well

This holiday season, why not treat your kids to a new CD-ROM called Grossology? What's it about? "It's slimy, oozy, stinky, smelly stuff explained. Grossology features the gag-rageous science behind the body's most disgusting functions: burps, vomit, scabs, ear wax, and more!" Care to learn more? Go to *www.GrossologyGames.com*, if you dare.

"I saw the flames when they started, too. I just thought it was part of the exhibit."

If your entry is used, we'll send you $50 and a *PC Magazine* T-shirt. Send your entries to Abort, Retry, Fail?, *PC Magazine*, One Park Ave., New York, NY 10016-5802 or send e-mail (text items only) to *don_willmott@zd.com*. Winners this issue: Stephen Rockower, Mac Sterline, Michael Thienes, Tal Uziely.

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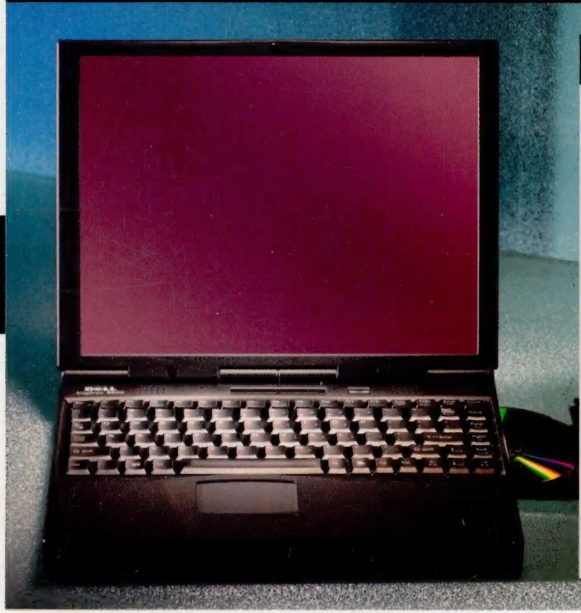

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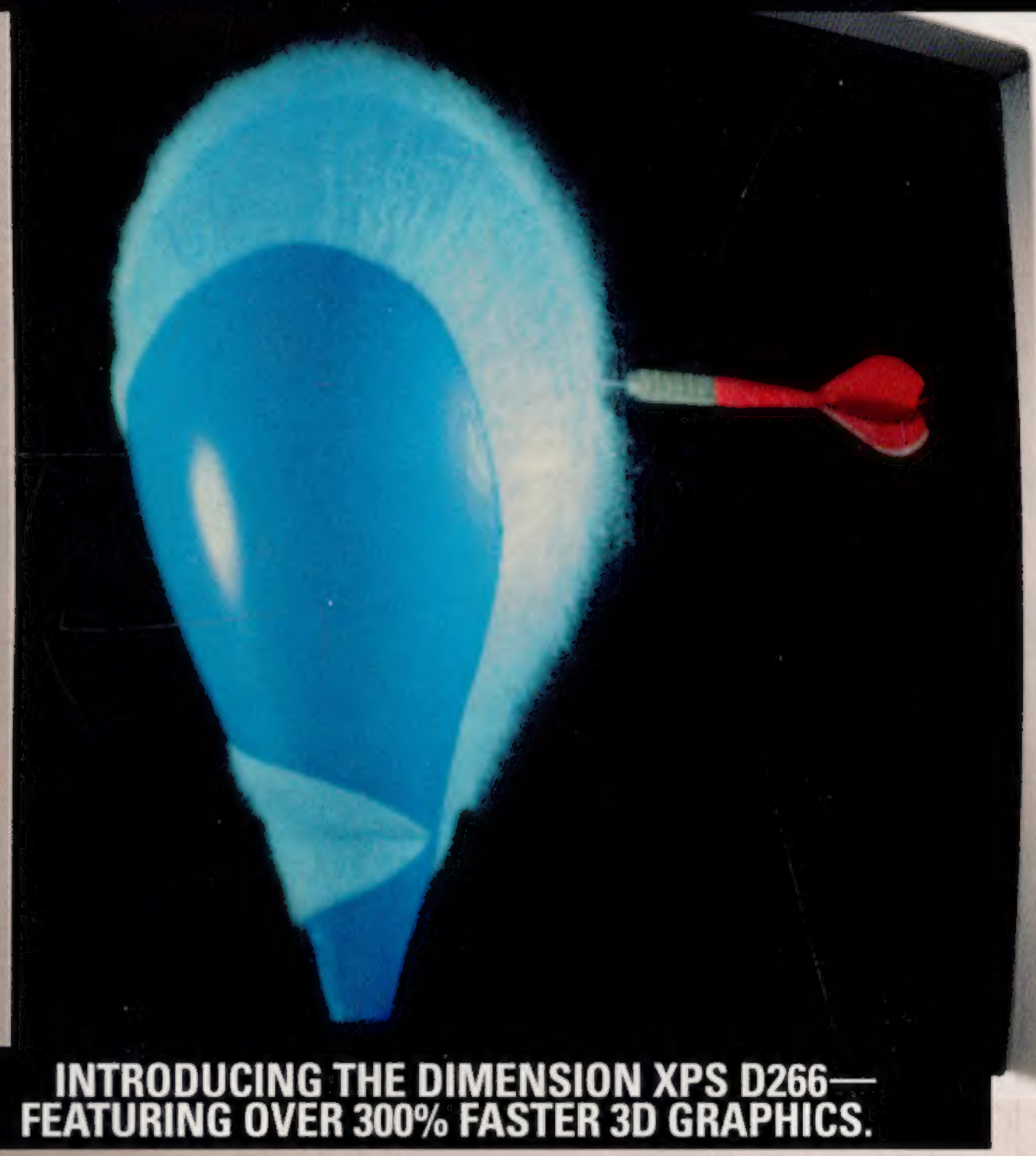

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